Report NAI-54-51
(ETR 2018)

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NORTHROP AIRCRAFT, INC.
HAWTHORNE, CALIFORNIA

QUALIFICATION TEST OF PILOT'S GAS-OPERATED EJECTION SEAT

13 Jan. 1954

VOL. _____ COPY NO. 4 of 9

Form 20-5 (P.4-52)

NORTHROP AIRCRAFT, INC.

HAWTHORNE, CALIFORNIA

REPORT NO. NAI-54-51

(REPORT NO. ETR 2018)

QUALIFICATION TEST OF PILOT'S GAS-OPERATED EJECTION SEAT

13 January 1954

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REVISIONS

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WITNESSED BY

USAF Quality Control

REFERENCES

Northrop Qualification Test Work Order 702018, Revision A
USAF Specification 25282-B
Northrop Drawings 5106277, 5125850, 5125880, 5131519
Northrop Engineering Order 92305
Northrop Reports ETR 2019, ETR 2059*, T-370, T-371

* Available only in files of Northrop Engineering Correspondence Control, Hawthorne, California

INCLUDED SPECIFICATIONS, DRAWINGS, AND PHOTOGRAPHS

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SUBJECT:

This report describes static tests made on a pilot's gas-operated ejection seat assembly. It also describes operational tests made on the seat adjusting and bottoming mechanisms. The tests were conducted in the Engineering Laboratory of Northrop Aircraft, Inc., Hawthorne, California, during the period 5 November 1953 to 18 December 1953.

OBJECT:

This program was performed to qualify the seat according to the requirements of USAF Specification 25282-B, in so far as revisions to the previous seat model design were concerned.

TEST SPECIMEN:

The pilot's seat was fabricated in accordance with Northrop Drawing 5125850, and was complete in all details except for the M3 and M4 initiators and the M5 catapult.

The specimen was mounted on a pair of ejection rails which were, in turn, supported by the steel jig shown in Figure 1, page 20 . A dummy catapult held the seat in position on the tracks. On the airplane installation, the catapult has a measure of rotational freedom about its trunnion that is restricted by a web of the Station 215.5 bulkhead. To simulate this effect in the test, a steel cross-bar was attached to the jig just aft of the catapult, at a distance of 27.5 inches below the trunnion.

TEST METHODS:

All tests of the seat were conducted while it was mounted in the aforementioned supporting jig. Static loads were applied by various means, and deflection and permanent set readings were made at points selected for maximum indications according to the particular test condition.

Temperature tests of the seat bottoming system were performed in the large altitude chamber at Northrop Aircraft, Inc. To measure the magnitude of jolts during operation, an accelerometer was attached to the right front corner of the seat pan, a relatively rigid portion. Two microswitches were installed, each of which indicated one of the extreme positions of the seat. Thus, with the switches wired in an on-off series circuit, the points at which seat motion started and stopped (terminal positions) could be indicated. By feeding this event indication to one channel of a Brush recorder,

TEST METHODS: (Continued)

the time required for the seat to move from the high to the low position could be measured. The accelerometer output was fed to the other channel of the Brush recorder, providing a time-history of seat accelerations and so a method of jolt measurement. The air bottle was charged to 1800 psig at room temperature before each run.

TEST RESULTS:

1. Personnel Catapult Load (Paragraph D-6a, USAF Specification 25282-B)

(Data, page 9 .)

(Photographs, pages 22 through 28 .)

A load of 6600 pounds ultimate, 4400 pounds proof, was applied downward parallel to the centerline of the rollers and through the combined center of gravity of the pilot and seat. The seat was adjusted to the low-aft (ejection) position. The load was distributed over the seat bottom by a 2-inch layer of firm rubber, surmounted by a 4-inch layer of wood planks and topped off with a 5/8-inch-thick slab of steel. A Baldwin-Southwark test machine was used to apply the load.

Reference to the companion report* on the radar operator's seat will show that at 5140 pounds load the catapult trunnion mounting bracket tore loose from the supporting jig. This bracket was very similar to the production part used on the pilot's seat installation. The main structural difference lies in the closer vertical location to the trunnion centerline of the two lower mounting bolts on the test part. This area on the pilot's seat had been strengthened after the preceding failure on the test of the radar operator's seat, so no similar collapse occurred during the pilot's seat test. The beefed-up dummy catapult used for the radar operator's seat test (ETR 2019) was also used for the pilot's seat.

Considerable bulging of the seat pan was observed during this test which caused some of the castings on the seat underside to tip so that gaps opened between the corners of the castings and the seat bottom. (See photographs, pages 23 through 25). Since it cannot be expected that

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* Northrop Report ETR 2019, Qualification Test of Radar Operator's Gas-Operated Ejection Seat, dated 8 December 1953.

TEST RESULTS: (Continued)

1. Personnel Catapult Load (Continued)

a thin panel remain flat during or after heavy normal loading, and also since the armrests worked freely after ultimate load, it is felt that this does not constitute a weakness. At 5730 pounds load, the front rivet attaching the seat-adjustment roller track to the seat pan failed in tension (see page 23). The testing of the seat was continued to ultimate load without further failure. The attachment of the track to the seat pan was then strengthened in pursuance of instructions contained in Engineering Order 92305 to Northrop Drawing 5125880 and reloaded to ultimate without recurrence of failure.

2. Seat Bottom Load (Paragraph D-6b, USAF Specification 25282-B).

(Data, page 10 .)

(Photographs, pages 22 through 28 .)

A load of 4000 pounds ultimate, 2665 pounds proof, was applied downward perpendicular to the seat pan and through the center of gravity of the pilot. The seat was adjusted to the high-forward position. This load was exerted in a Baldwin-Southwark test machine and distributed over the seat bottom in the same manner used for the personnel catapult load test (page 2).

After the initial failure of the front rivet attaching the seat-adjustment roller track to the seat pan during the previous load condition, the seat bottom had been hammered flat and a new rivet installed, but the local strengthening of this area as mentioned on page 3 had not been made. At a load of 2900 pounds in this condition, the rivet pulled out again. The test was then rerun with the strengthening added to the area, and reached ultimate load without failure.

No other failures occurred. There was some bulging of the seat bottom (see photographs, pages 26 through 28) as described in the previous test, but, again, it is not felt that this should be considered a weakness.

TEST RESULTS: (Continued)

3. Seat Back Loads (Paragraph D-6c, USAF Specification 25282-F).

(Data, page 11 .)

(Photographs, pages 29 and 30 .)

A load of 1500 pounds ultimate, 1000 pounds proof, was applied rearward normal to the seat back and distributed over an area equal to that occupied by a packed parachute. The seat was adjusted to the high-forward position. This was done both with and without the 5106277 parachute back spacer. The seat was tilted so that the back was horizontal, and was loaded in the specified area with dead weights. Maximum deflections were much less than the 5/8-inch maximum allowed by the USAF Specification. No failure was noted.

4. Front Edge Load (Paragraph D-6d, USAF Specification 25282-B).

(Data, page 12 .)

(Photograph, page 31 .)

A down load of 400 pounds ultimate, 270 pounds proof, was applied to the top front edge of the seat bottom, over a length extending 1.5 inches each side of the centerline, and normal to the seat bottom. The seat was tilted so that the seat bottom was horizontal, and a basket containing dead weights was balanced on the 3-inch length on the front edge. No failure was noted.

5. Armrest Loads (Paragraph D-6e, USAF Specification 25282-B).

(Data, page 13 .)

(Photographs, pages 32 and 33 .)

A down load of 300 pounds ultimate, 200 pounds proof, was applied to each armrest at the center of the arm guard, in a direction parallel to the rollers. An outward load of 100 pounds was applied to each armrest at the same point, in a horizontal direction. All the loads were exerted with a hydraulic cylinder and measured with a dynamometer ring. No failures were noted.

TEST RESULTS: (Continued)

6. Handgrip Loads (Paragraph D-6f, USAF Specification 25282-B).

(Data, page 14 .)

(Photographs, pages 34 and 35 .)

A load of 100 pounds ultimate, 70 pounds proof, was applied to the upper end of each handgrip in both a forward and a rearward direction, parallel to the armrests. All the loads were applied with a hydraulic cylinder and measured with a ring dynamometer. No failure was noted.

7. Headrest Load (Paragraph D-6f, USAF Specification 25282-B).

(Data, page 15 .)

(Photograph, page 36 .)

A distributed load of 200 pounds ultimate, 130 pounds proof, was applied to the headrest in an aft direction parallel to the seat bottom. The jig was tilted so that the seat bottom was vertical, and shot bags were distributed over the head rest. No failures were noted.

8. Safety Belt Load (Paragraph D-6i, USAF Specification 25282-B).

(Data, page 16 .)

(Photograph, page 37 .)

A forward load of 2880 pounds ultimate, 1920 pounds proof, was applied to the seat through the lap belt and its mountings. The belt was adjusted so that the sides of the belt were inclined 20 degrees inward from the sides of the seat and 40 degrees up from the bottom of the seat. A forward load of 2080 pounds ultimate, 1385 pounds proof, was applied to the seat through the shoulder harness and takeup mechanism, parallel to the seat bottom. The takeup mechanism was in the unlocked, extended position. The seat was adjusted to the mid-position. The two loads were applied simultaneously with hydraulic cylinders and measured with ring dynamometers. No failures were noted.

When the shoulder harness takeup cable is fully extended,

TEST RESULTS: (Continued)

8. Safety Belt Load (Continued)

the triangular metal fitting on the aft end of the strap rides on the pipe over which the harness passes. Therefore, for this test, the 10C420-625 extension on the reel cable was removed and the harness was fastened directly to the reel cable itself, avoiding a severe bending of the metal end fitting. If actual service loads are expected on the shoulder harness in this position, it would be well to shorten the cable extension slightly so that there will not be any interference as described.

After the above test had been completed, a change in the test work order was received asking that the test be conducted with the takeup cable in the fully retracted position. This meant only a change in the loads in the takeup mechanism itself; it was therefore decided to apply the loads through the shoulder harness only. This was done with the 10C420-625 cable extension in place and the load pulled forward parallel to the seat bottom. No failure occurred.

9. Seat-Adjustment "A"-Frame Load

(Data, page 17 .)

(Photographs, pages 38 and 39 .)

This test condition was conducted as an evaluation of the installation of the A-frame casting (Northrop Drawing 5131519) used under the pilot's seat to aid in its adjustment. This loading was not required by any USAF Specification.

The seat was adjusted to the low-aft position and an ultimate load of 1000 pounds was applied horizontally to the left through the center of gravity of the pilot. The load was transmitted from the center of gravity to the seat proper by a steel box frame bolted through the lap belt attach holes and clamped to the sides of the seat pan. Deflections were measured at the front end of the A-frame and at the top and bottom rear of the seat.

The seat proved to be very rigid under this loading, with negligible permanent set at proof load and a maximum side deflection at ultimate load of about 1/4 inch at the top of the seat.

No sign of failure was detected in either the seat or the A-frame.

TEST RESULTS: (Continued)

10. Seat Adjustment Test (Paragraph D-2a (1), USAF Specification 25282-B).

This was an investigation of the forces on the seat bottom contributed by the spring-loaded A-frame under the seat. It was specified in the test work order that this load should not exceed 150 pounds with the seat in the lowest position and should be less than 35 pounds with the seat in the highest position. It was found that there is sufficient friction in the bottoming cylinders to hold the seat in either position, without load in the seat pan. Even so, the seat could be nudged slightly when in the low-aft position and caused to rise part way.

The test was started with the seat in the high-forward position and the adjustment locking pins withdrawn. Shot bags were piled in the seat pan until movement was noted and the total weight was then recorded. Bags were added until the seat reached the low-aft position and the total weight was again recorded. As a matter of interest, this same procedure was re-run with the bottoming cylinders disconnected from the seat. The seat was found to operate within the specified limits in this case also. The latter proved much freer. See page 18 for actual figures.

11. Seat Operation at Temperature (Paragraph D-2a (2), USAF Specification 25282-B).

(Data, pages 19 and 21 .)

(Photographs, pages 40 and 41 .)

Seat bottoming tests were conducted at temperatures of -65, -35, +60 (room temperature), and +160 degrees Fahrenheit. Maximum acceleration recorded was 11G, with durations from 15 to 20 milliseconds. See page 21 for a typical record. Time to bottom was less than 1 second for all runs except that at -65 F, which required 1.22 seconds. It is not felt that this is critical, since it is not likely that the system will ever be charged at room temperature and then operated at -65 F.

The net load holding the seat in the low-aft position after activation of the bottoming cylinders was also measured. This was 700 pounds or more from -35 F to

TEST RESULTS: (Continued)

11. Seat Operation at Temperature (Continued)

+160 F, but at -65 F it was only 410 pounds. This is below the specification minimum of 450 pounds, but, for the same reason mentioned above, it is not felt that this is a realistic condition.

DISCUSSION:

In several cases, particularly during loads on the armrests, permanent sets were obtained, after proof load, which amounted to a considerable percentage of the deflection at proof load. Normally, during static tests of rigid parts or assemblies, it is specified that there shall be negligible permanent set after limit load. This is not explicitly stated in the applicable USAF Specification 25282-B.

In this particular test, it is not felt that this is an applicable requirement for three reasons. First, due to the nature of the seat there is a good deal of slop which cannot be entirely eliminated and which will show up as permanent set. Second, the operation of the seat was not impaired after having been subjected to ultimate loads. Third, test reports* of the preceding model seats used on the F-89 showed permanent sets of comparable magnitude and these seats have been accepted for service by the USAF.

CONCLUSIONS:

This seat has met the test requirements of USAF Specification 25282-B.

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* Northrop Report T-370, Static and Temperature Test of Pilot's Ejection Seat Assembly, Part Number 565311 "C", dated 24 January 1951; and

Northrop Report T-371, Static Test - R.O. Ejection Seat Assembly, Part Number 565248 "D", dated 24 January 1951.

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SUBJECT

PILOT'S GAS-OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Personnel Catapult Load Test
(Paragraph D-6a, USAF Specification 25282-B)

Load (Lbs)	Deflection (Inches)			
	1	2	3	
500	0	0	0	
2200	.36	.20	.008	
500	.14	.09	-.002	
3300	.66	.58	.018	
500	.23	.16	.003	
4400	.91	.82	.023	Proof Load
500	.27	.21	.014	
5500	1.12	1.06	.024	
500	.33	.27	.023	
6600	1.29	1.23	.023	Ultimate Load
500	.37	.32	.029	

Deflection locations (see photographs, pages 22 through 28):

1. Footrest, left side, down positive.
2. Footrest, right side, down positive.
3. Seat back, top center, forward positive.

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SUBJECT

PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Seat Bottom Load Test
(Paragraph D-6b, USAF Specification 25282-B)

Load (Lbs)	Deflection (Inches) 1	2	3	4	
500	0	0	0	0	
1500	.24	.38	.002	.51	
500	.11	.08	.004	.15	
2665	.45	.45	-.008	.77	Proof Load
500	.15	.19	.001	.24	
3300	.55	.56	-.013	1.19	
500	.15	.20	-.002	.22	
4000	.67	.68	-.018	1.44	Ultimate Load
500	.17	.21	.003	.29	

Deflection locations (see photographs pages 22 through 28):
1. Footrest, left side, down positive.
2. Footrest, right side, down positive.
3. Seat back, top center, forward positive.
4. Seat bottom, right forward corner, down positive.

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SUBJECT

PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Seat Back Load Tests
(Paragraph D-6c, USAF Specification 25282-B)

Load (Lbs)	Deflection (Inches)					
	1	2		1	2	
0	0	0		0	0	
300	.018	-		.030	.052	
700	.020	-		.033	.089	
1000	.024	.239		.034	.116	Proof Load
0	.013	.019		-.009	-.003	
1250	.013	.273		.023	.160	
1500	.008	.310		.022	.183	Ultimate Load
0	-.012	.026		-.019	.002	
	without parachute back spacer			with parachute back spacer		

Deflection locations (see photographs pages 29 and 30):
1. Seat bottom, front center, down positive.
2. Seat back, top center, aft positive.

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PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Front Edge Load Test

(Paragraph D-6d, USAF Specification 25282-B)

Load (Lbs)	Deflection (Inches) 1	2	
0	0	0	
270	.305	.120	Proof Load
0	.015	.013	
400	.387	.160	Ultimate Load
0	.020	.009	

Deflection locations (see photograph page 31):

1. Front edge centerline, down positive.
2. Front edge centerline, aft positive.

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PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Arm Rest Load Tests

(Paragraph D-6e, USAF Specification 25282-B)

Load (Lbs) Side	Deflection (Inches) LH Side	Deflection (Inches) RH Side	Load (Lbs) Down	Deflection (Inches) LH Down	Deflection (Inches) RH Down	
10	0	0	25	0	0	
25	.048	.026	100	.021	.010	
50	.126	.078	25	.007	.001	
25	.068	.037	200	.046	.027	Proof Load
75	.199	.139	25	.010	.002	
25	.074	.048	300	.077	.045	Ultimate Load
100	.269	.203	25	.008	.002	
25	.081	.053				
10	.023	.018				

Deflection locations (see photographs pages 32 and 33):
Down loads, aft end of handgrip, down positive.
Outward loads, aft end of handgrip, out positive.

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SUBJECT: PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE: Hand Grip Load Tests
(Paragraph D-6f, USAF Specification 25262-B)

Load (Lbs)	Deflection (Inches) LH Fwd	LH Aft	RH Fwd	RH Aft	
10	0	0	0	0	
25	.002	.001	.001	.001	
50	.007	.005	.005	.004	
25	.005	.003	.003	.003	
70	.011	.008	.008	.006	Proof Load
25	.005	.004	.003	.004	
100	.019	.012	.012	.011	Ultimate Load
25	.007	.003	.004	.006	
10	.003	.001	.001	.003	

Deflection locations (see photographs pages 34 and 35):
All loads, aft end of handgrip.
Forward loads, up positive.
Aft loads, down positive.

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PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE

Head Rest Load Test

(Paragraph D-6h, USAF Specification 25282-B)

Load (Lbs)	Deflection (Inches)	
0	0	
130	.244	Proof Load
0	.010	
200	.312	Ultimate Load
0	.011	

Deflection location (see photograph page 36):
Rear center, aft positive.

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SUBJECT: PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE: Safety Belt Load Test
(Paragraph D-6i, USAF Specification 25282-B)

Load (% Ultimate)	Load (Lbs) Lap Belt	Load (Lbs) Shoulder Harness	Deflection (Inches) 1	2	3
0	0	0	-	-	-
10	288	208	0	0	0
25	720	520	.014	.014	.011
50	1440	1040	.063	.057	.021
67	1920	1385	.099	.087	.025
10	288	208	.066	.032	.018
85	2460	1780	.187	.195	.035
100	2880	2080	.241	.256	.045
10	288	208	.170	.191	.027

Deflection locations (see photograph page 37):
1. Footrest, left side, down positive.
2. Footrest, right side, down positive.
3. Seat back, top center, aft positive.

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SUBJECT: PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

TEST PHASE: 5131519 Seat Adjustment A-Frame Casting Installation Load Test

Load (% Ultimate)	Load	Deflection (Inches)			
	Lbs	1	2	3	
0	0	0	0	0	
20	200	.020	-.020	.042	
40	400	.046	-.060	.090	
60	600	.084	-.104	.146	
67	670	.093	-.116	.167	Proof Load
0	0	.017	-.006	.017	
67	670	.095	-.116	.168	
80	800	.112	-.141	.202	
100	1000	.145	-.190	.259	Ultimate Load
0	0	.023	-.021	.042	

Load applied horizontally to left through C.G. of pilot, seat adjusted to low aft position.

Deflection locations (see photographs pages 38 and 39):

1. A-frame, front end, left positive.
2. Lower seat support link, front end, left positive.
3. Upper seat support link, front end, left positive.

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PILOT'S GAS-OPERATED EJECTION SEAT ASSEMBLY

Seat Adjustment Loads

Seat Load Required to:	USAF Spec.	Seat In Operational Adjustment	Bottoming Cylinders Disconnected
Start down	Not less than 35 lbs.	75 lbs.	40 lbs.
Bottom	Not more than 150 lbs.	105 lbs.	60 lbs.

PILOT'S GAS OPERATED EJECTION SEAT ASSEMBLY

Bottoming System Operational Tests

Ambient Temperature	Reservoir Pressure	Full Travel Time	Maximum Acceleration Start	Maximum Acceleration Stop	Acceleration Duration	Net Down Force
(°F)	(PSI)	(SEC.)	(G)	(G)	(SEC.)	(LBS)
-65	1340	1.22	(see Note 2)			410
-35	1475	.61	11	2.5	.02	700
+60	1800	.67	10	4	.02	700
+160	2100	.41	11	5	.015	700+

Notes:

1. Travel time does not include the time necessary to raise the armrest

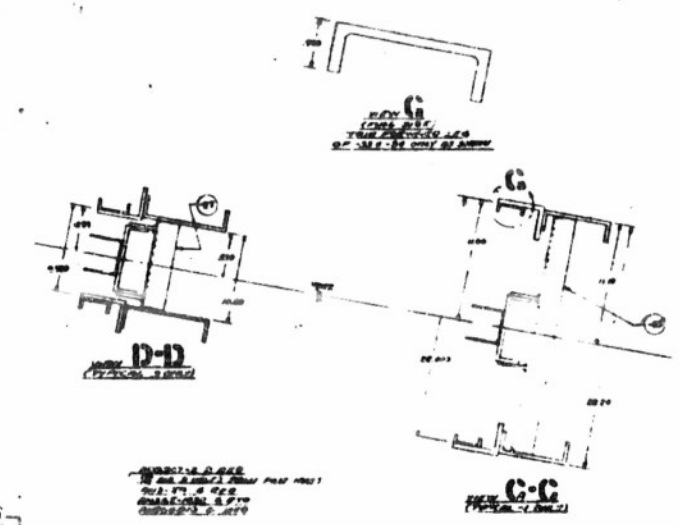
2. Accelerometer not functioning. By observation, operation was smoother than at -35 F.

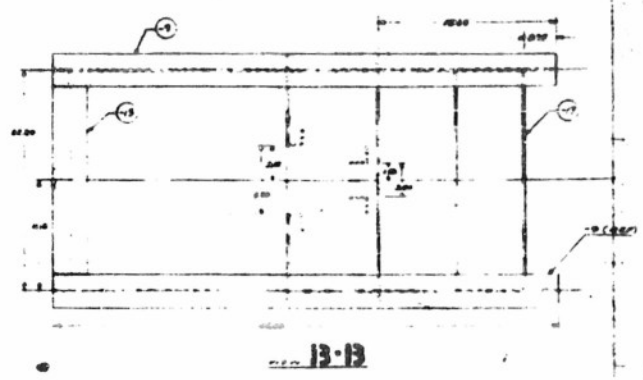
3. See Figure 2, page 21 , for a typical acceleration record.

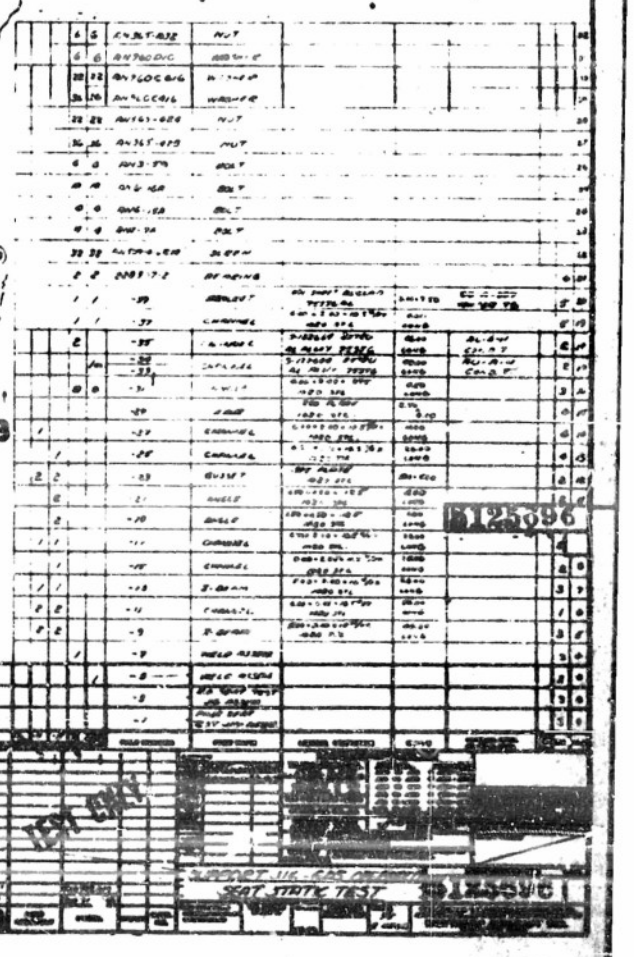
4. For more information of this group of tests see Northrop Report ETR 2059, Design Test of Pilot's Seat-Lowering Cylinder Assembly 2125777, dated 11 December 1953, available in the files of Engineering Correspondence Control, Northrop Aircraft, Inc., Hawthorne, California.

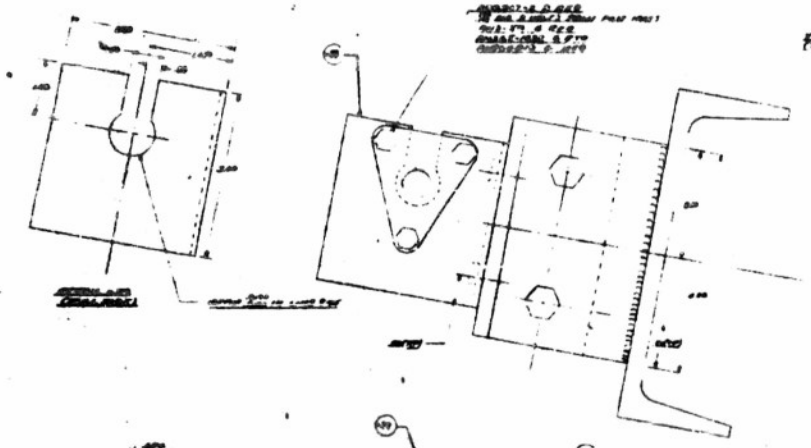
5. See pages 40 and 41 for photographs of test setup.

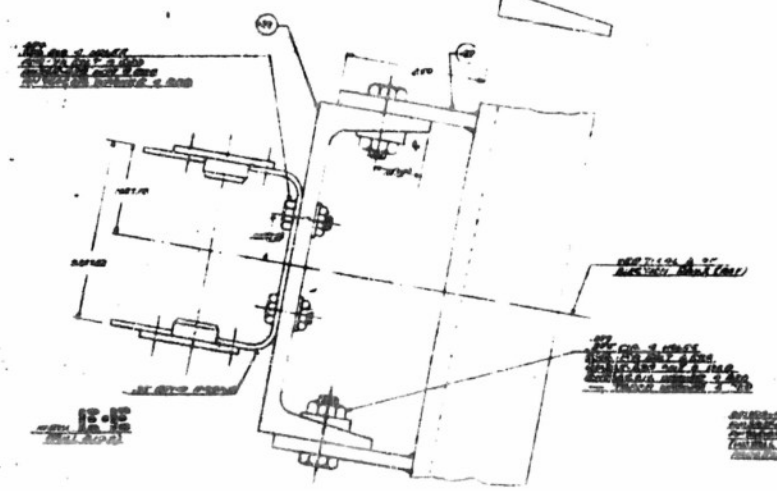
FIGURE 1.

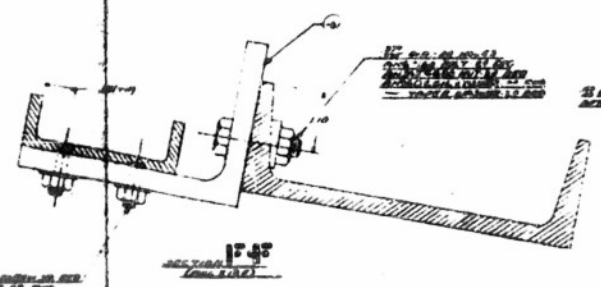


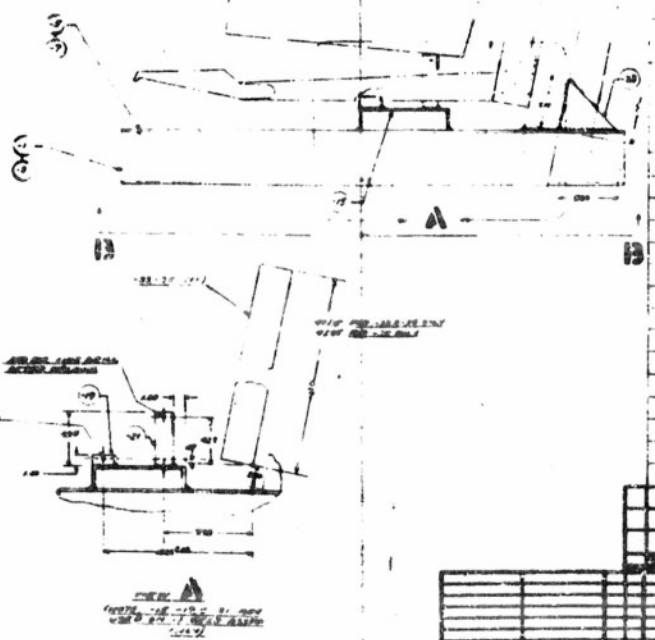








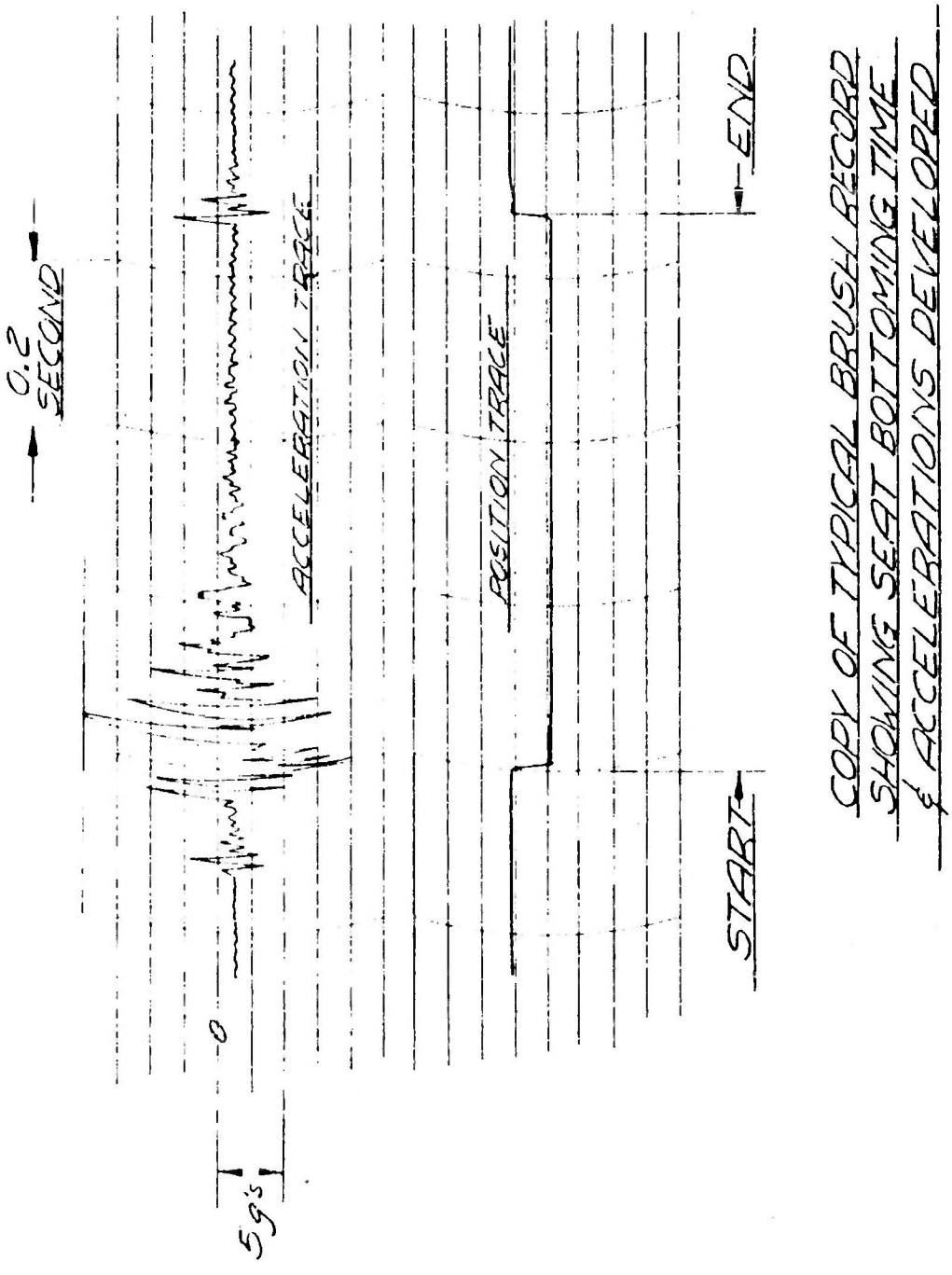




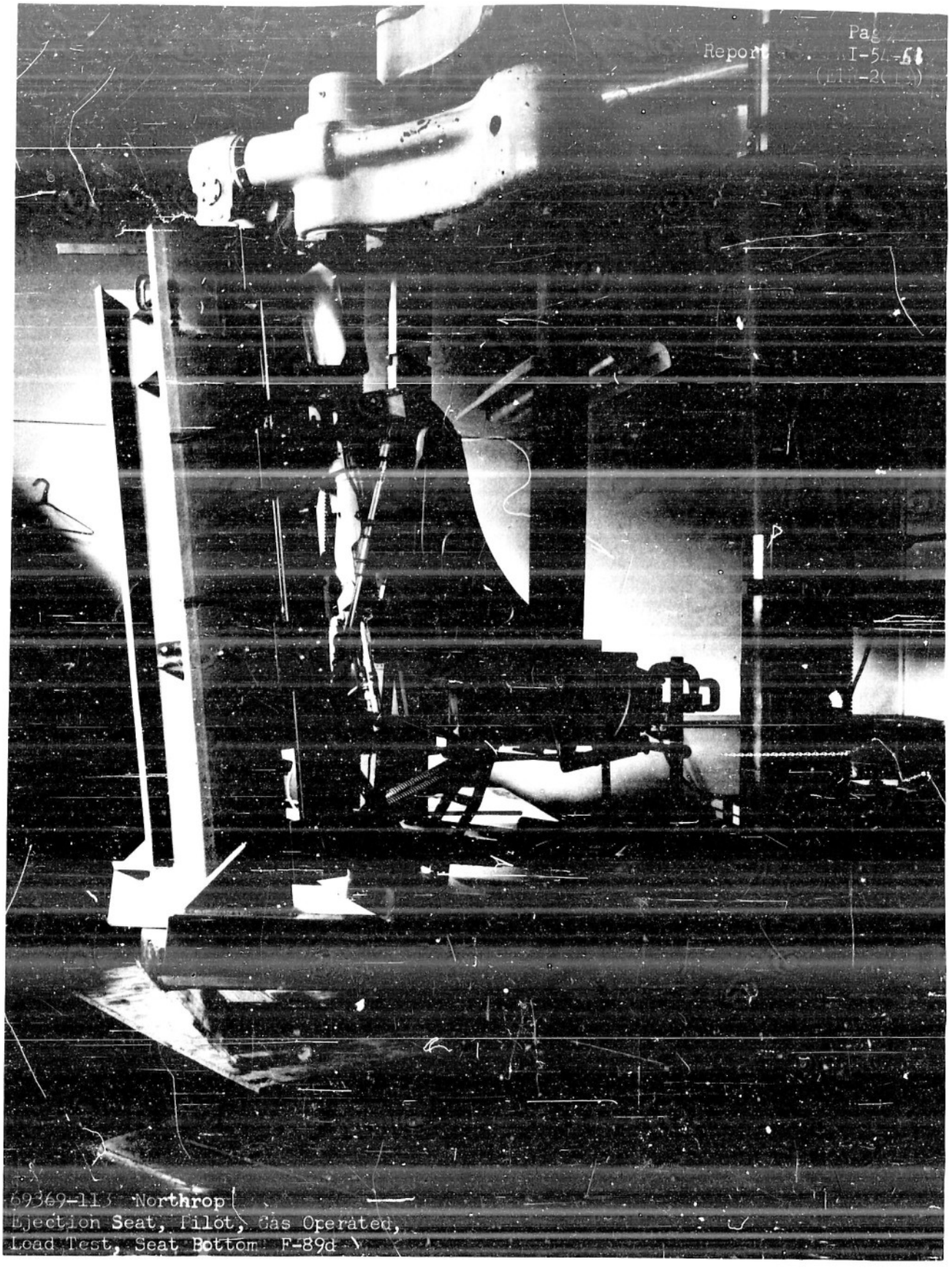
FORM 50-7A
(R. 9-51)

ENGINEER	NORTHROP AIRCRAFT, INC.	PAGE
D. M. Cole, Jr.		21
CHECKER		REPORT NO.
		ETR 2018
DATE		MODEL
13 January 1954		F-89D

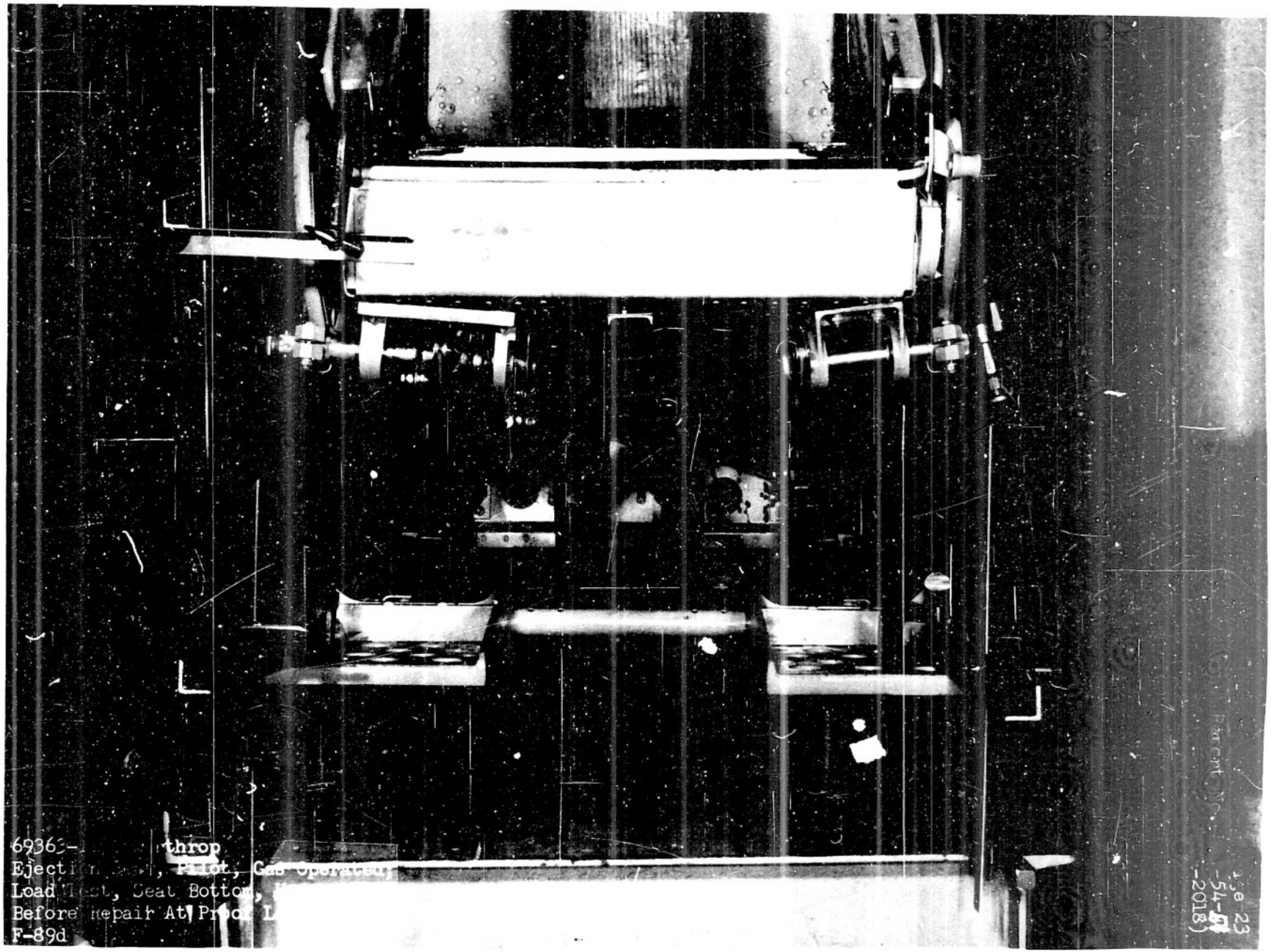
FIGURE 2

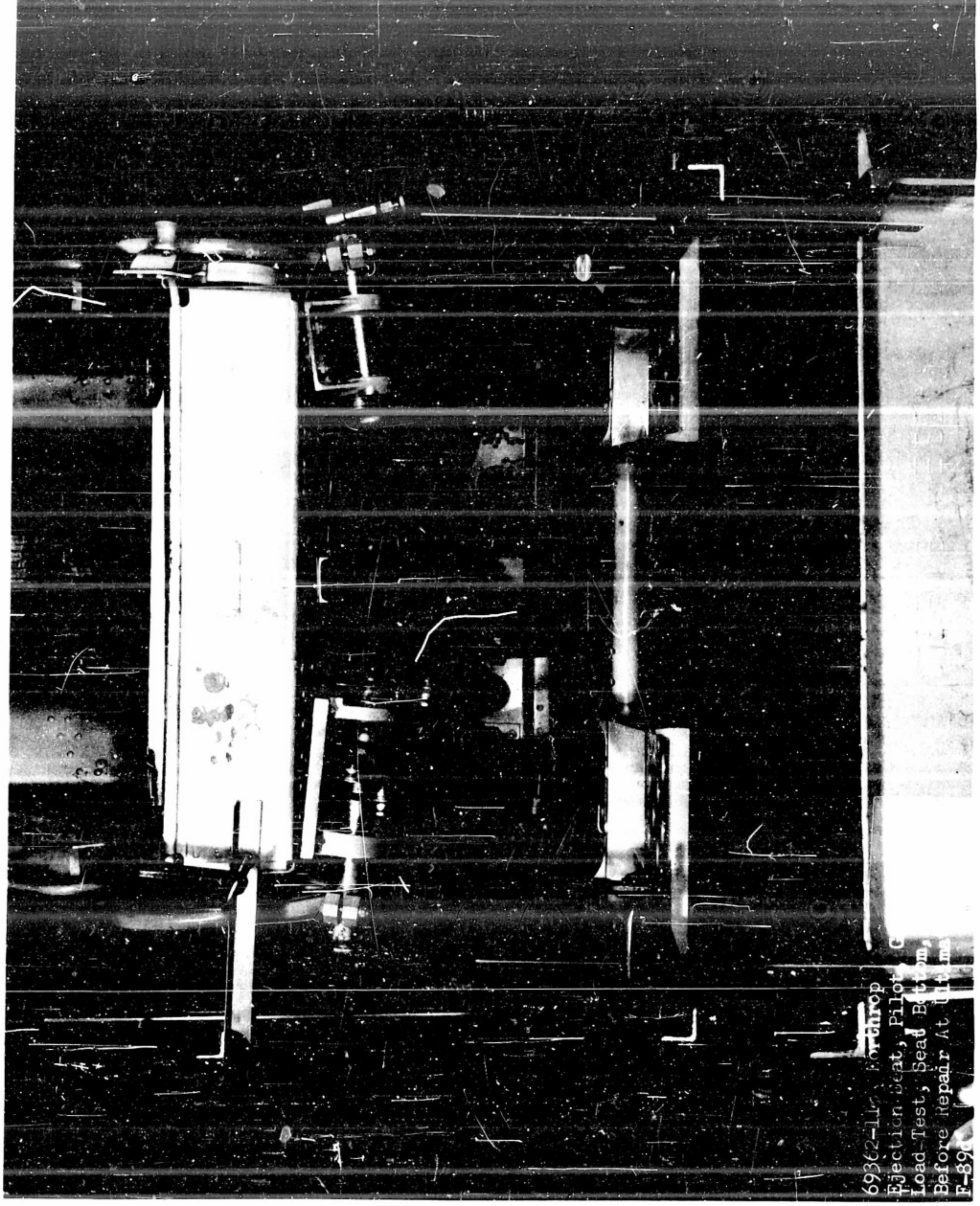


COPY OF TYPICAL BRUSH RECORD SHOWING SEAT BOTTOMING TIME & ACCELERATIONS DEVELOPED

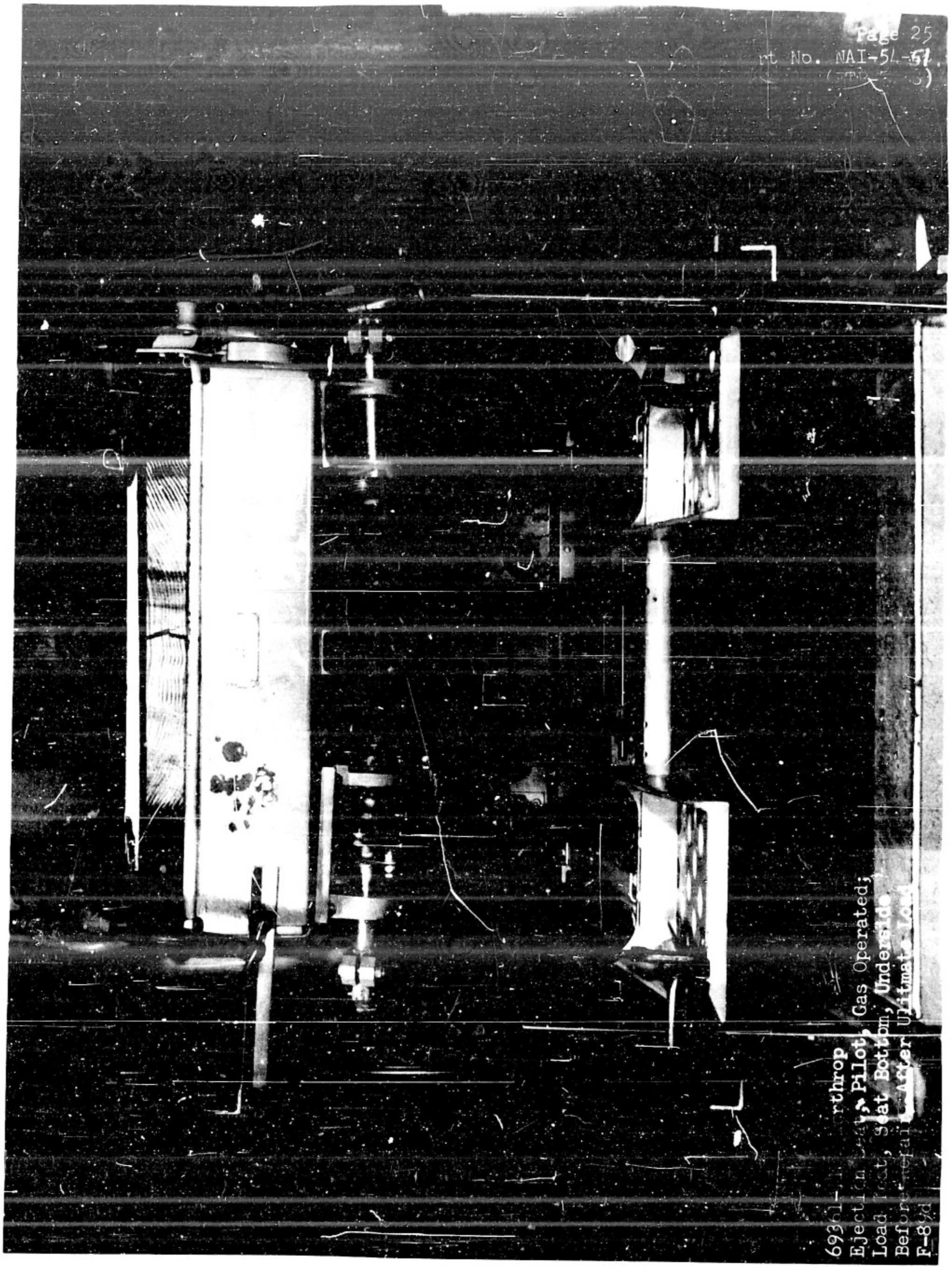


69369-113 Northrop
Ejection Seat, Pilot, Gas Operated,
Load Test, Seat Bottom F-89d

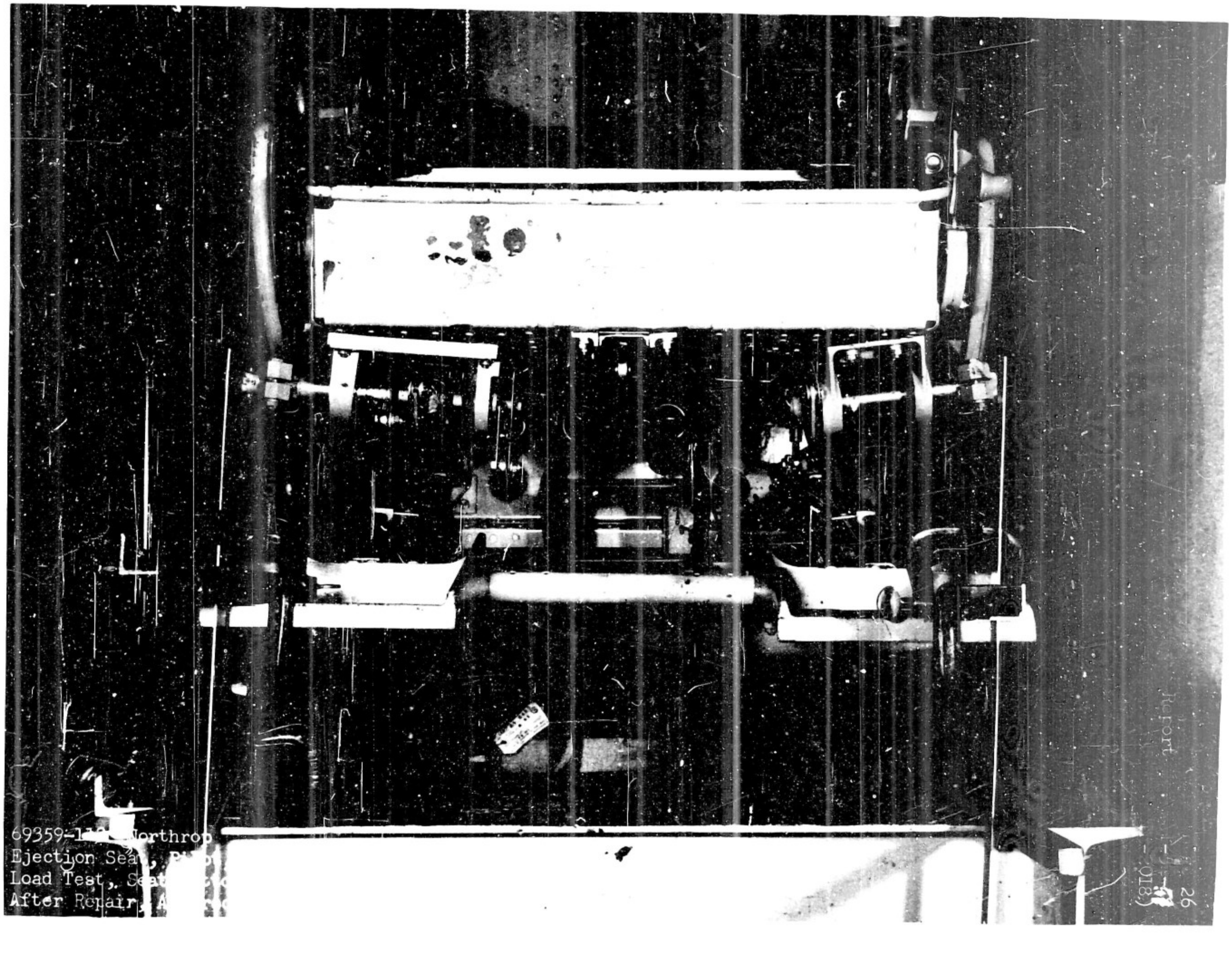

69363-
throp
Ejecti
Pilot, Gas Operated
Load Test, Seat Bottom,
Before Repair At Proof L
F-89d
Part No. 23
-54-
-2018)



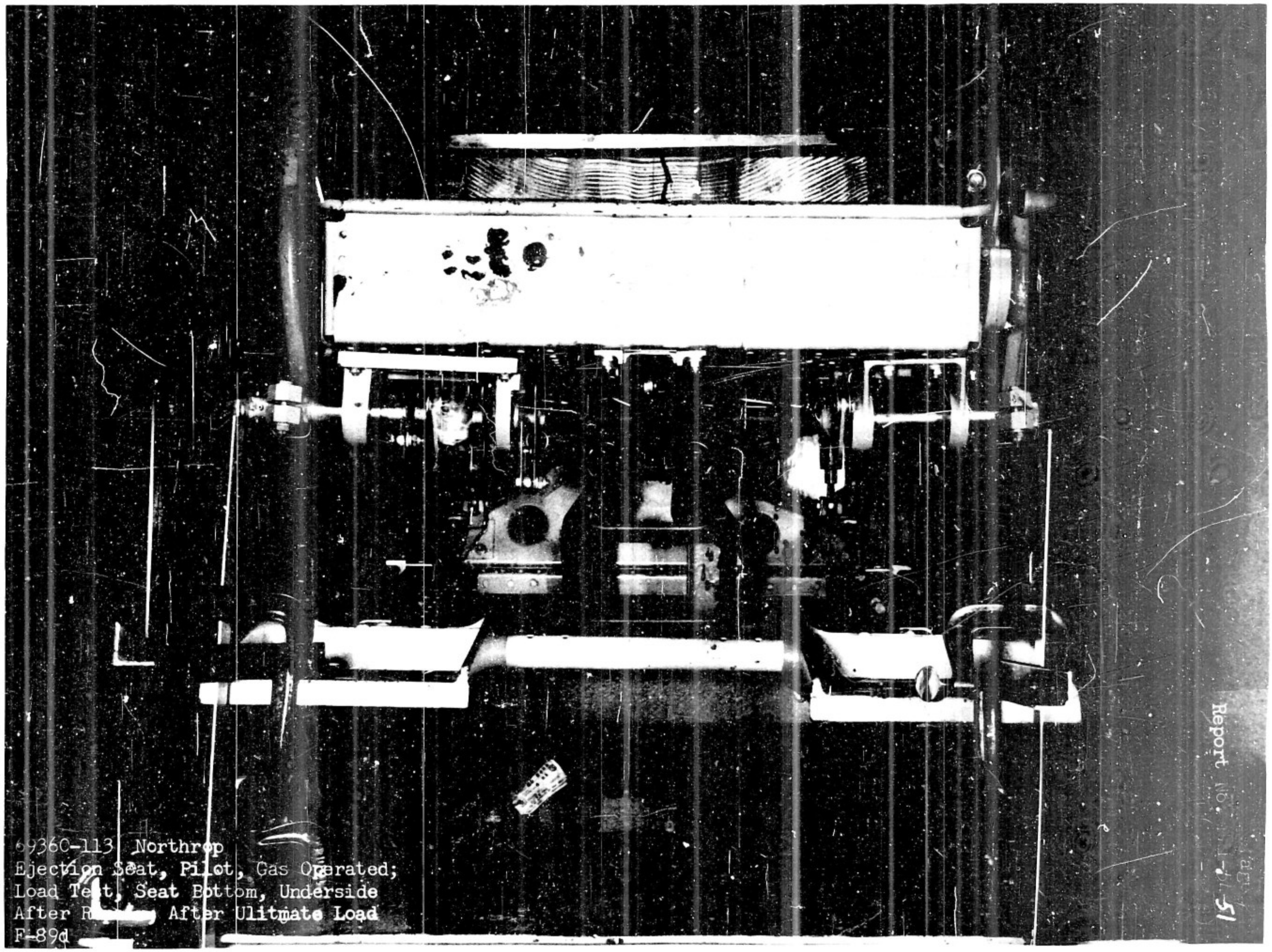
69362-11 Northrop
Ejection Seat, Pilot, G
Load Test, Seat Bottom,
Before Repair At Ultima
F-89



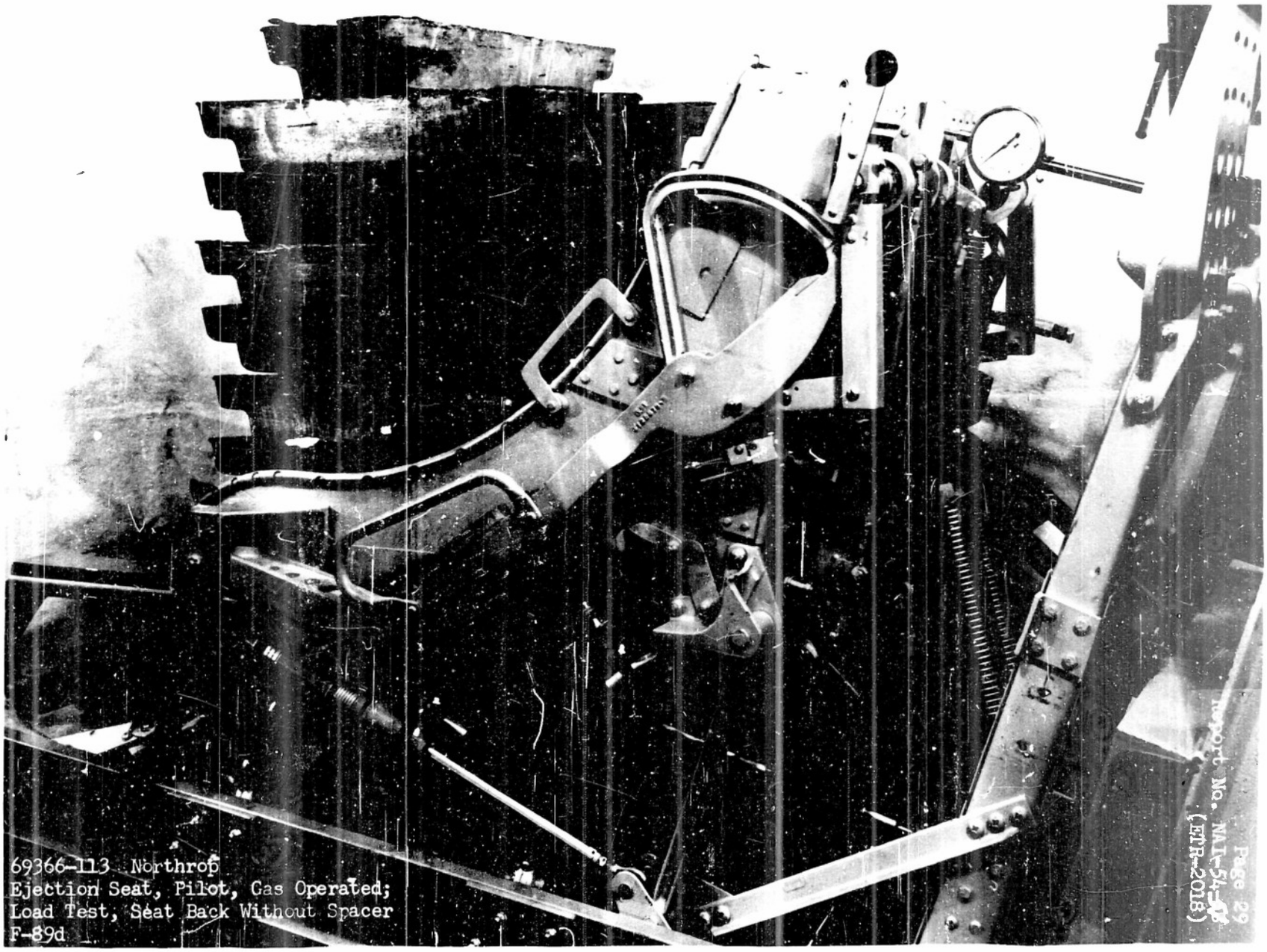
69361-... Northrop
Ejection Seat, Pilot, Gas Operated;
Load Test, Seat Bottom, Underside
Before Repair, After Ultimate Load
F-89d



69359-1 Northrop
Ejection Seat,
Load Test, Seat
After Repair,

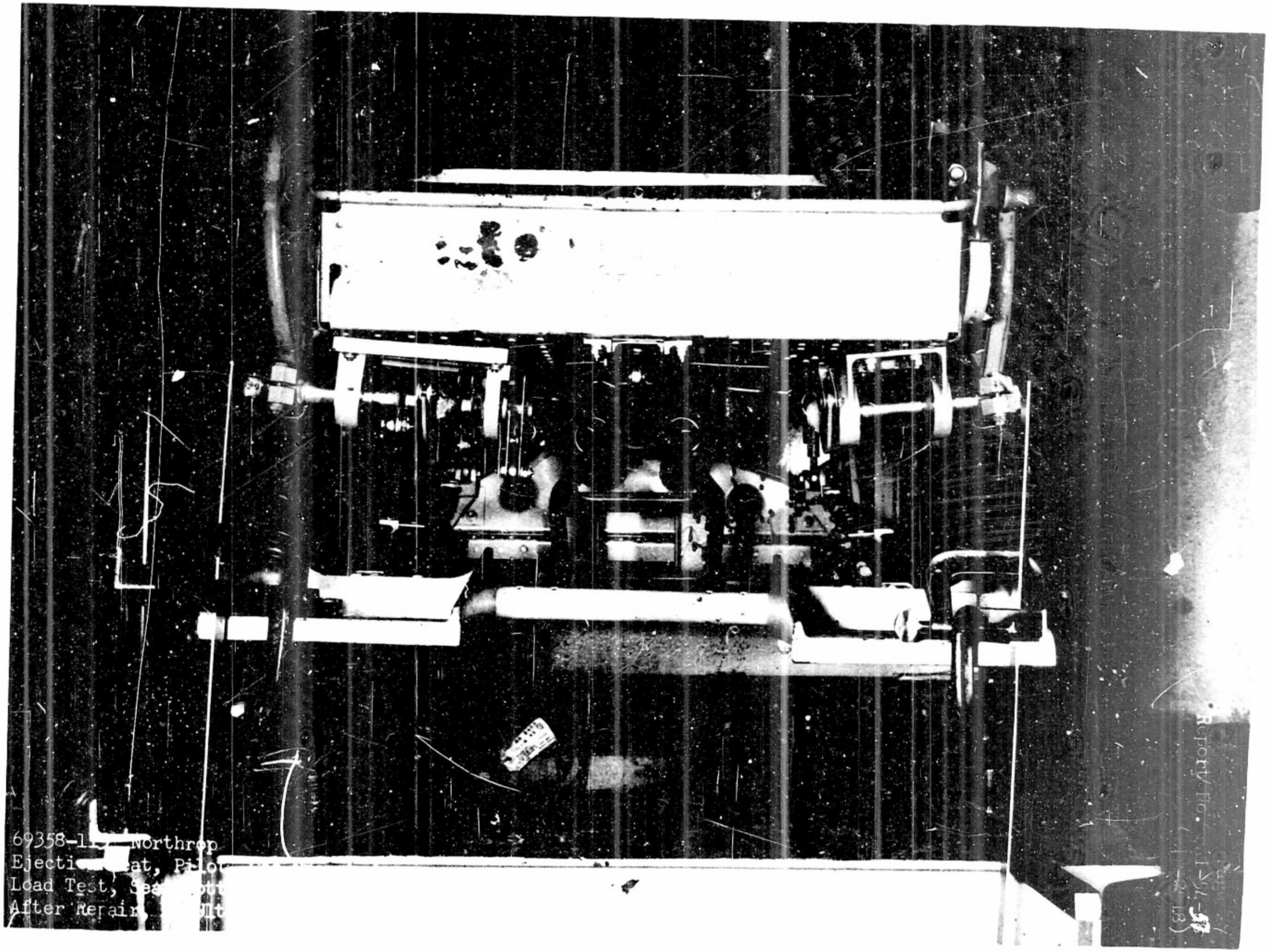


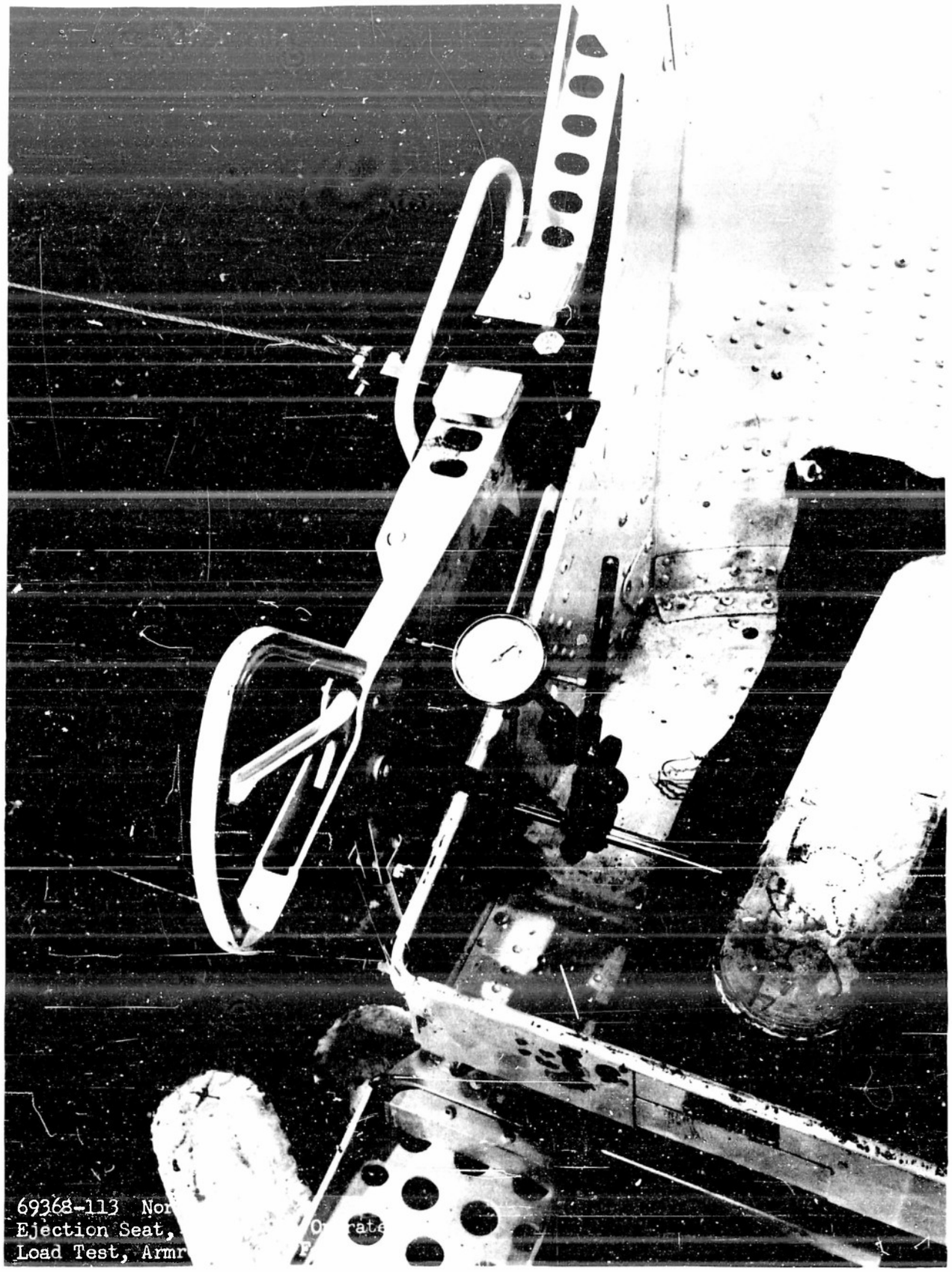
69360-113 Northrop
Ejection Seat, Pilot, Gas Operated;
Load Test, Seat Bottom, Underside
After R[illegible], After Ulitmate Load
F-89d



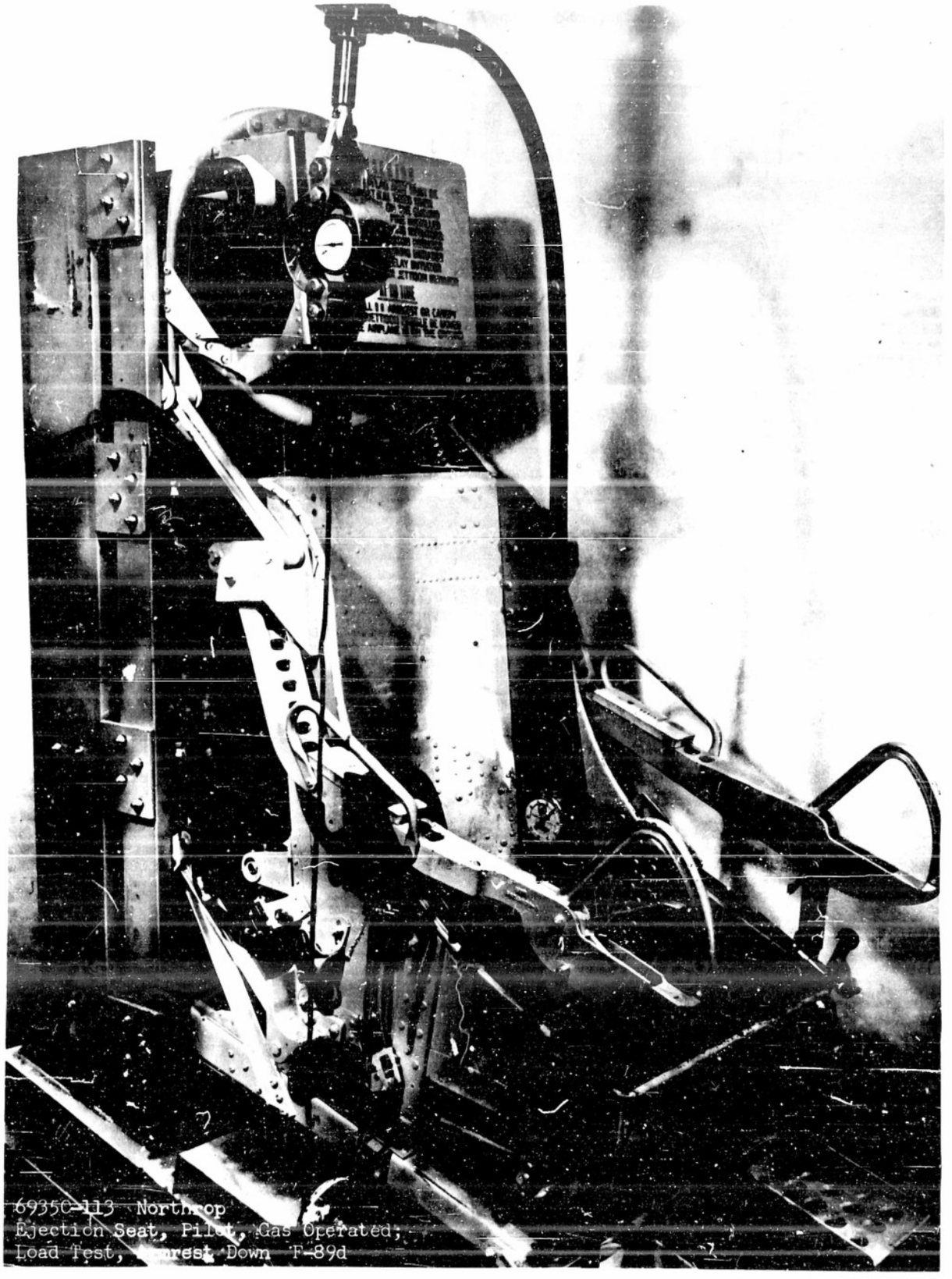
69366-113 Northrop
Ejection Seat, Pilot, Gas Operated;
Load Test, Seat Back Without Spacer
F-89d

69365-113 [illegible]hrop—
Ejection, S[illegible] Pilot, Gas Operate[illegible]
[illegible]ad Test, [illegible]eat Back With Space[illegible]

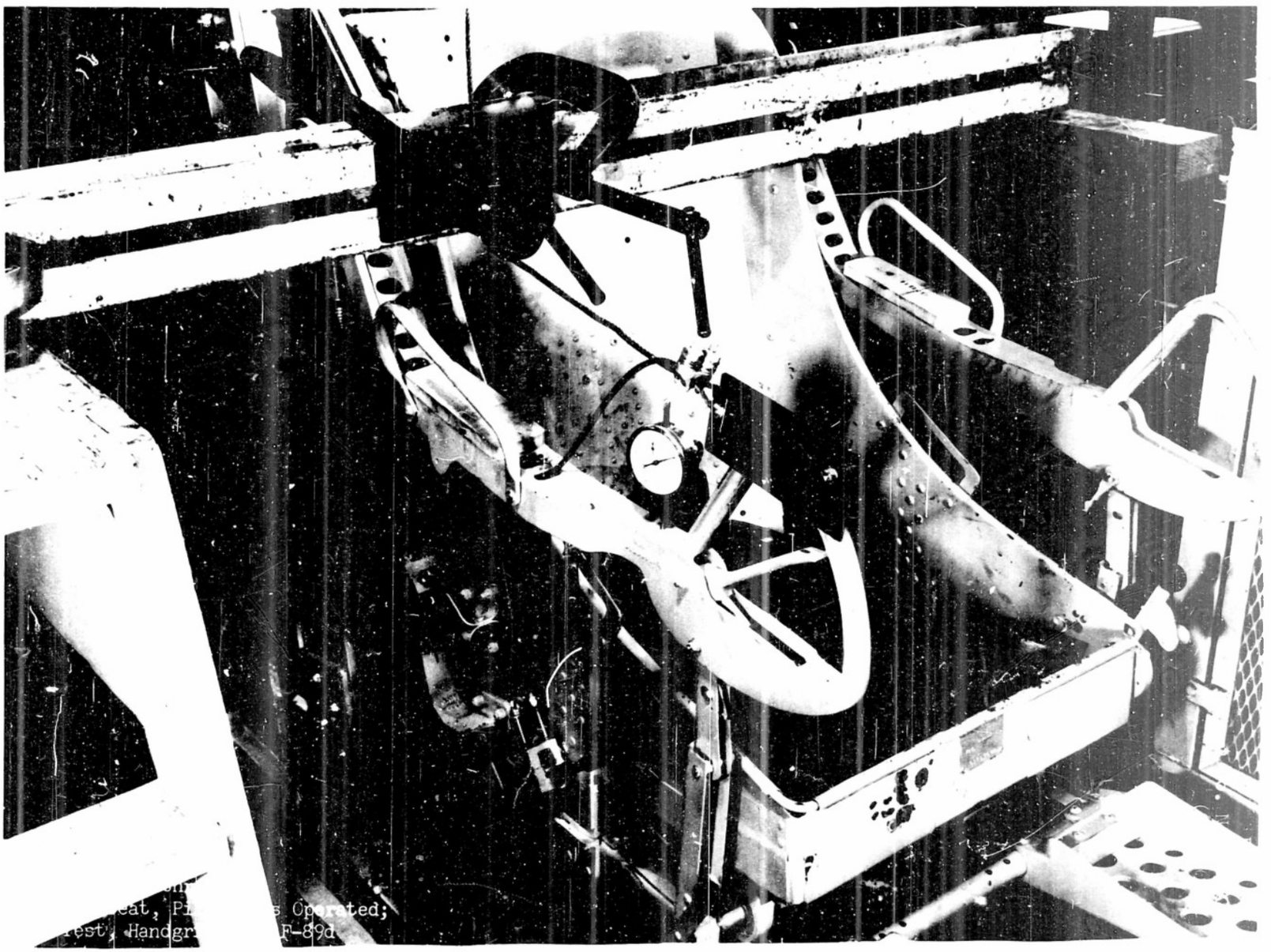

69358-1 Northrop
Ejecti at, Pilo
Load Test, Sea
After Repair
Report No.



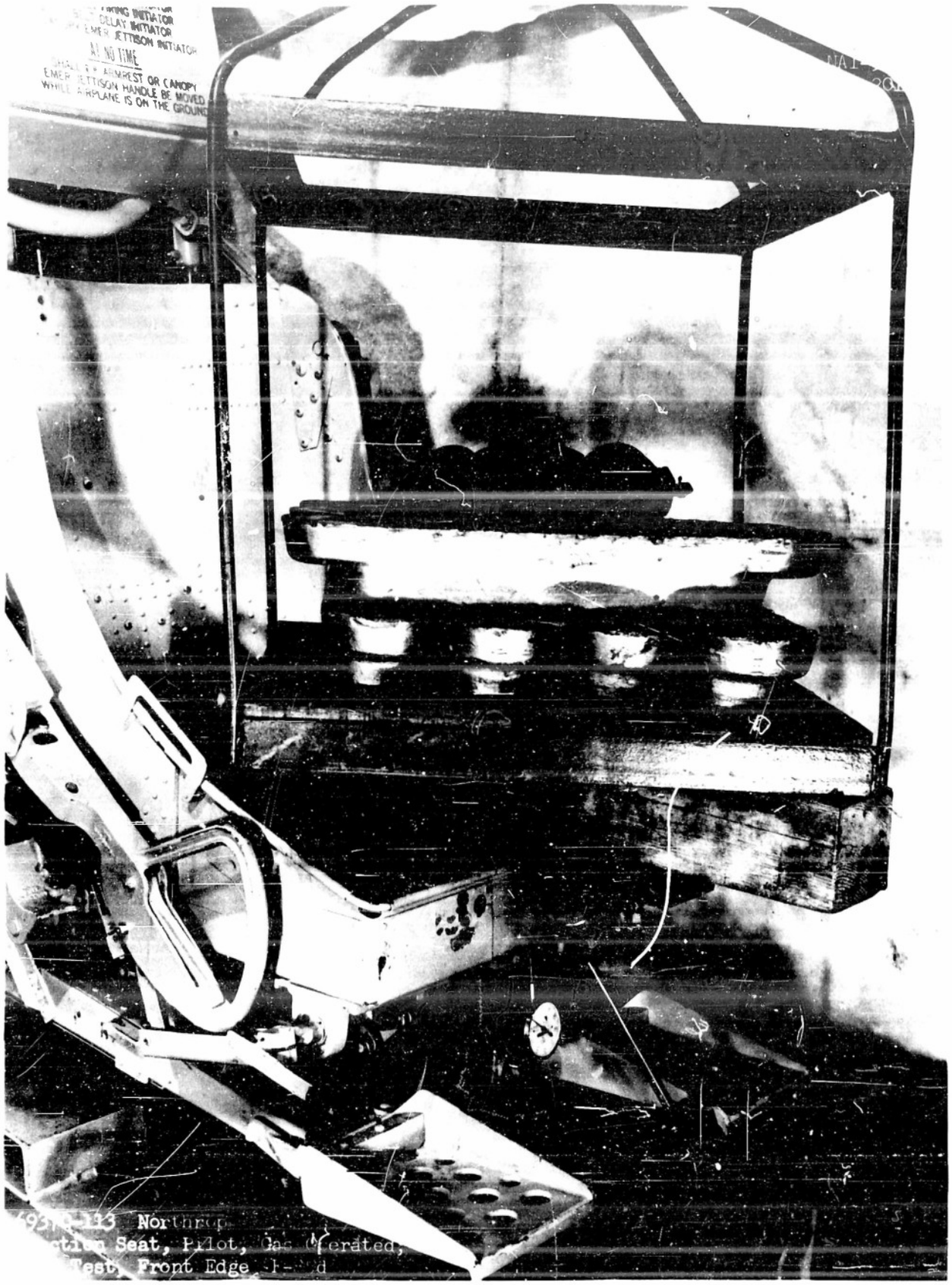
69368-113 Nor
Ejection Seat,
Load Test, Armr



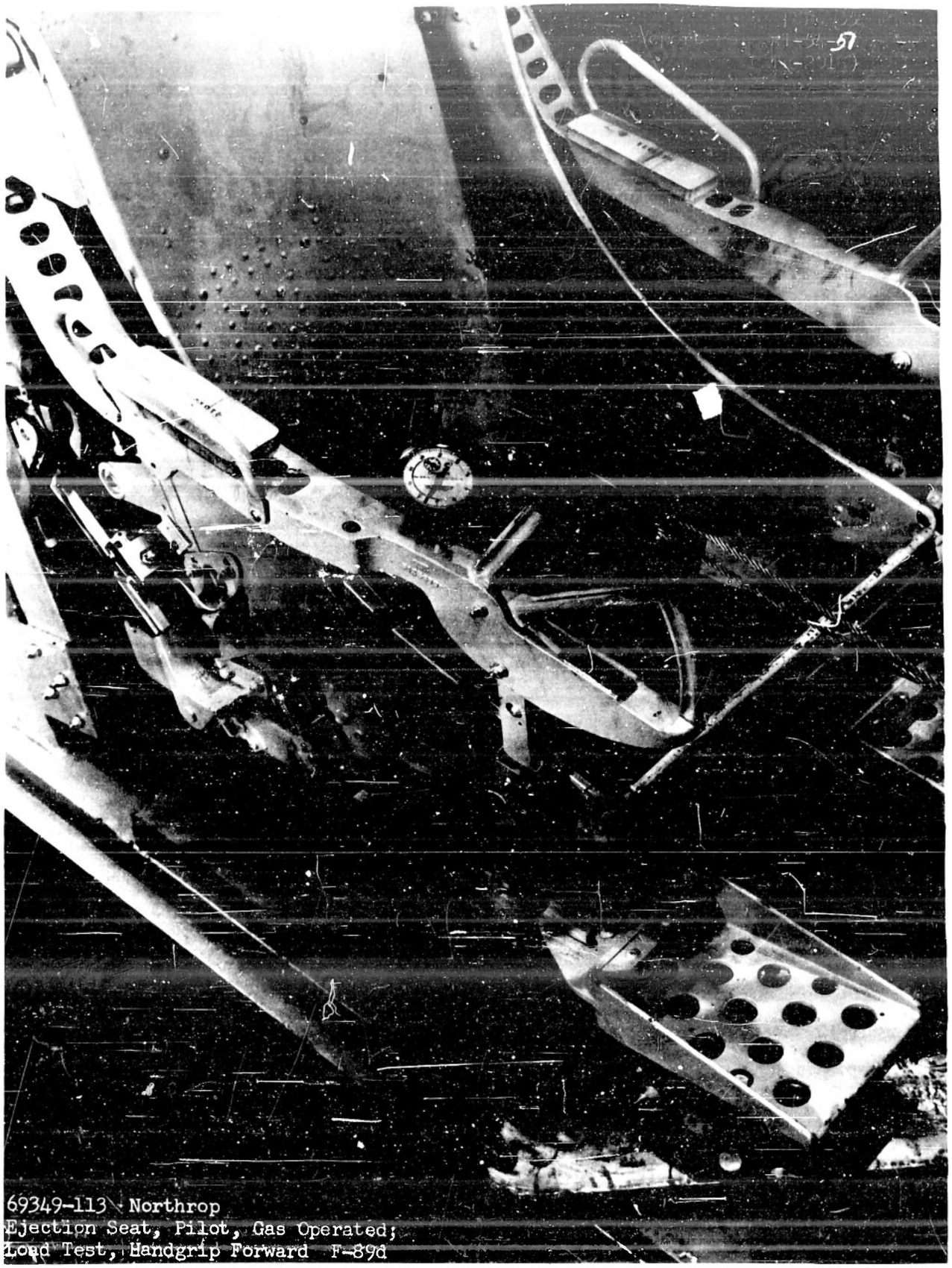
69350-113 Northrop
Ejection Seat, Pilot, Gas Operated;
Load Test, Headrest Down F-89d



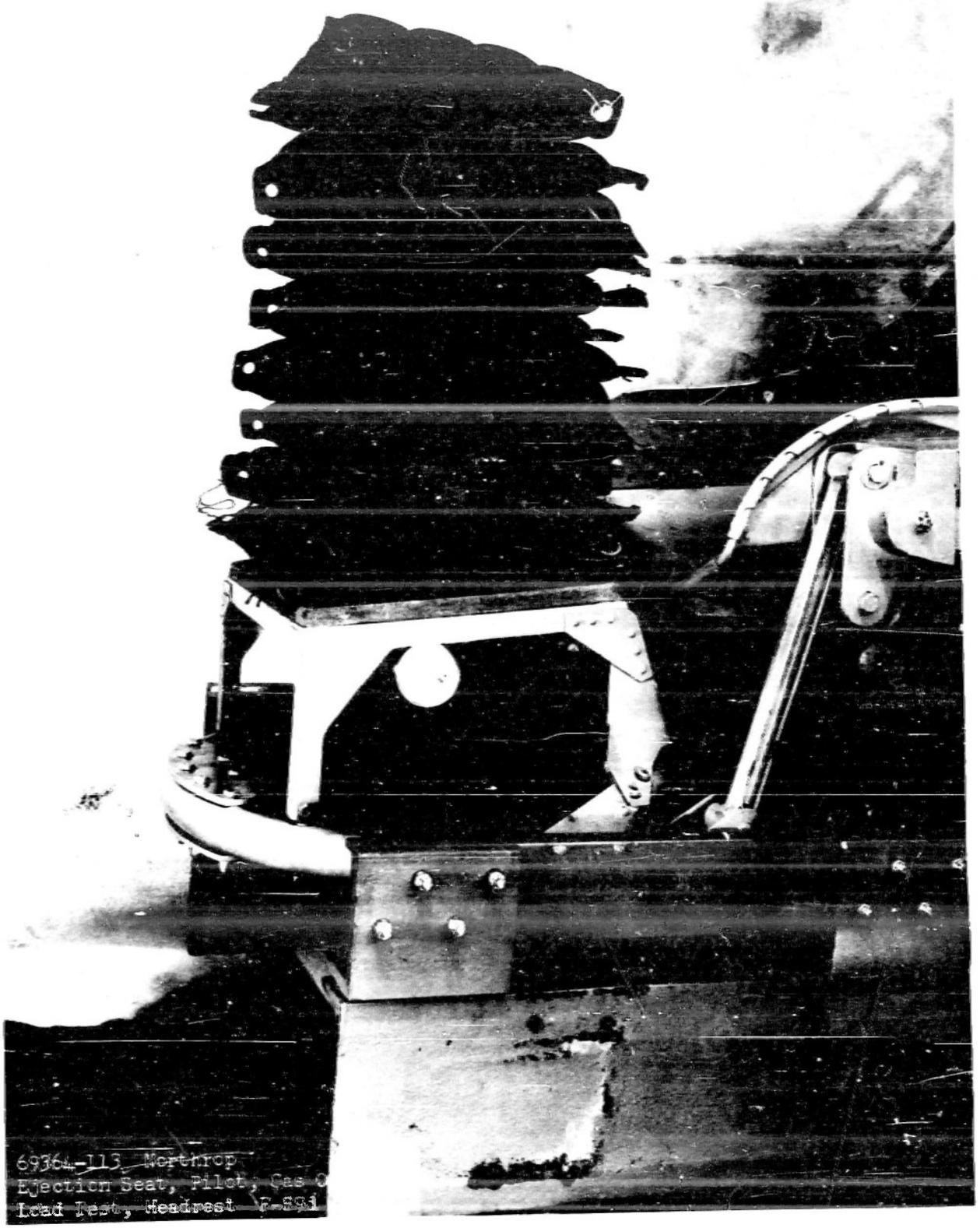
...eat, Pi... Operated;
...est, Handgr... F-89d

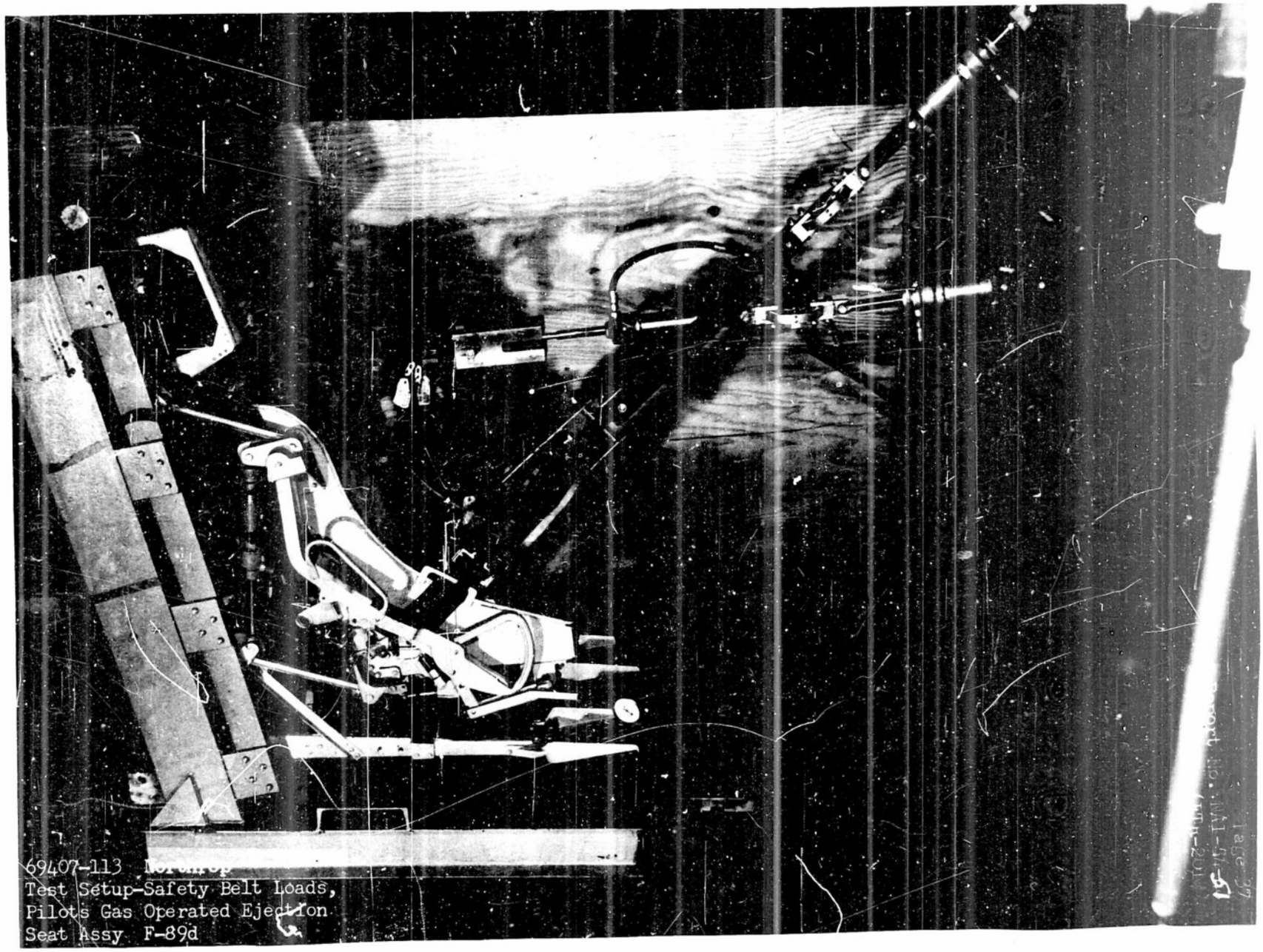


Northrop
Seat, Pilot, Gas Operated,
Front Edge

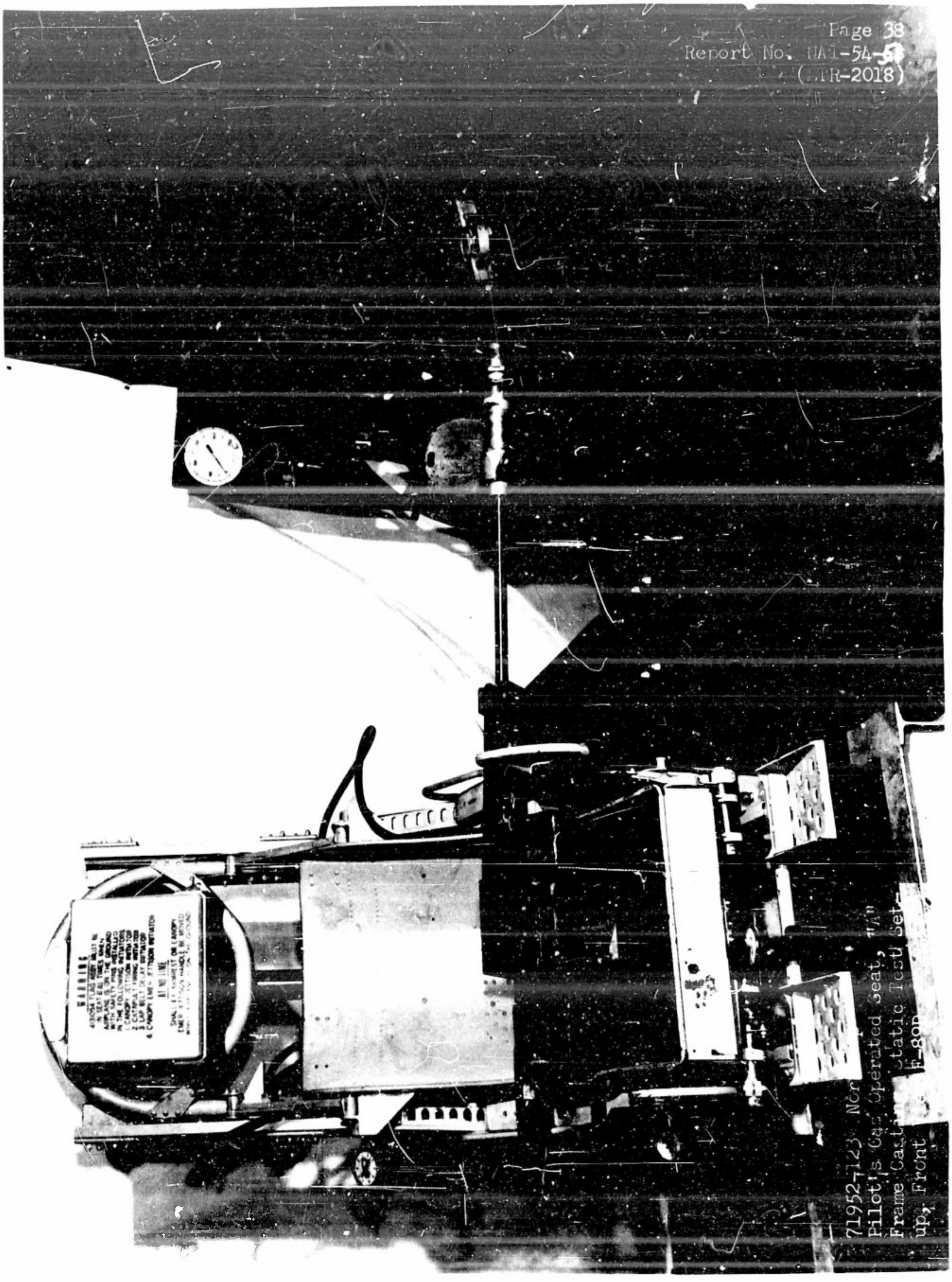


69349-113 - Northrop
Ejection Seat, Pilot, Gas Operated;
Load Test, Handgrip Forward F-89d

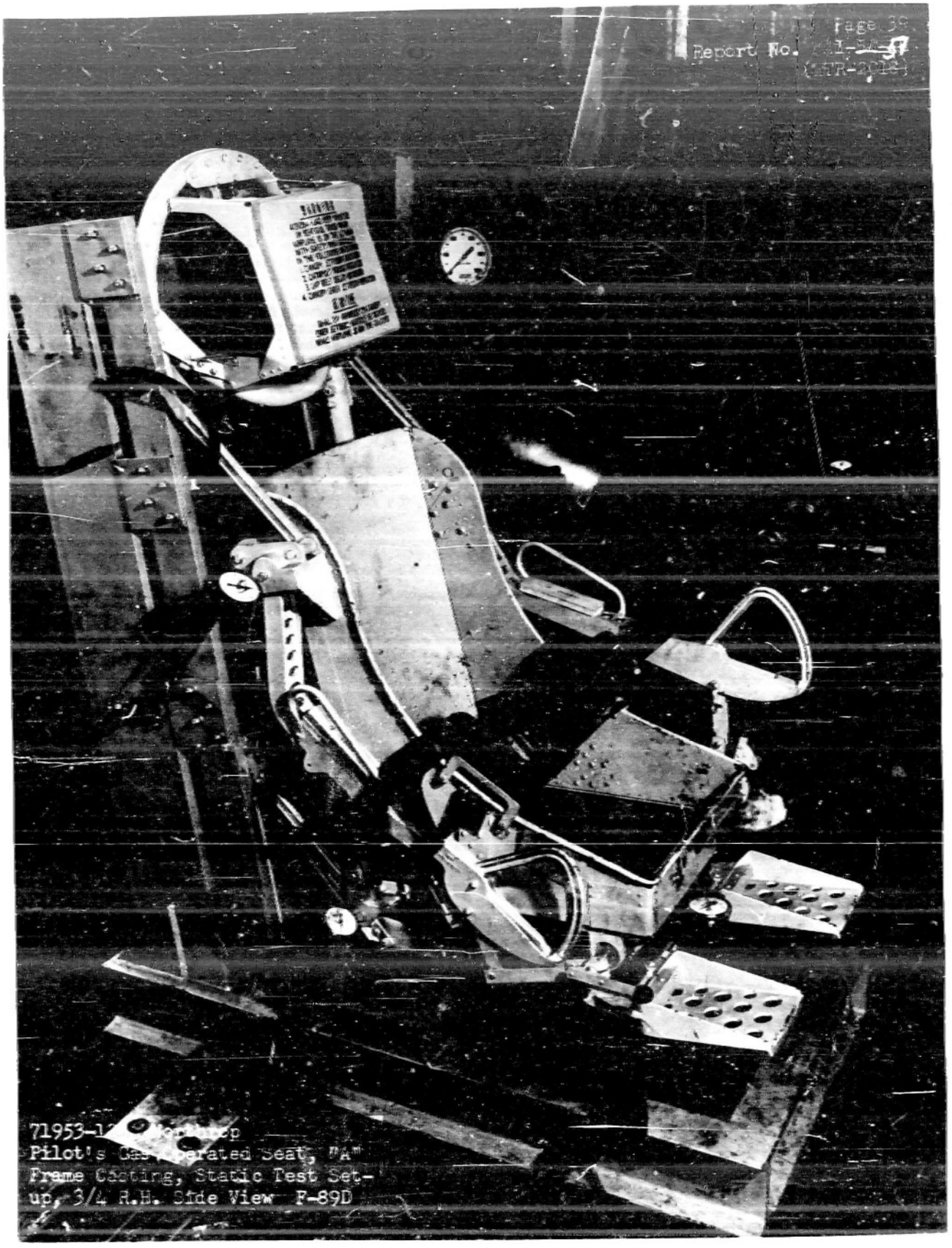

69364-113 Northrop
Ejection Seat, Pilot, Case
Load Test, Headrest F-89J



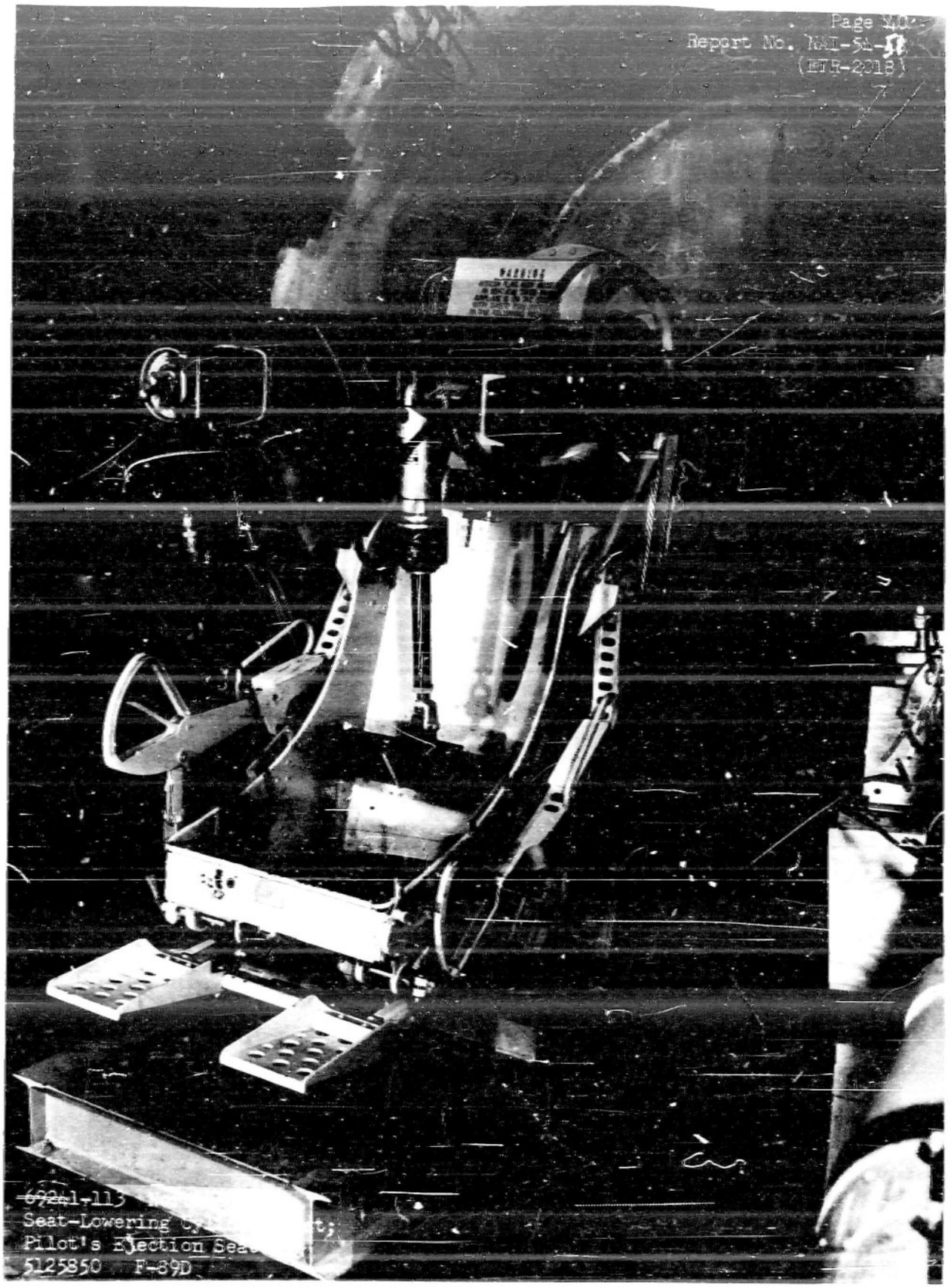
69407-113 Norair Dept.
Test Setup-Safety Belt Loads,
Pilots Gas Operated Ejection
Seat Assy F-89d



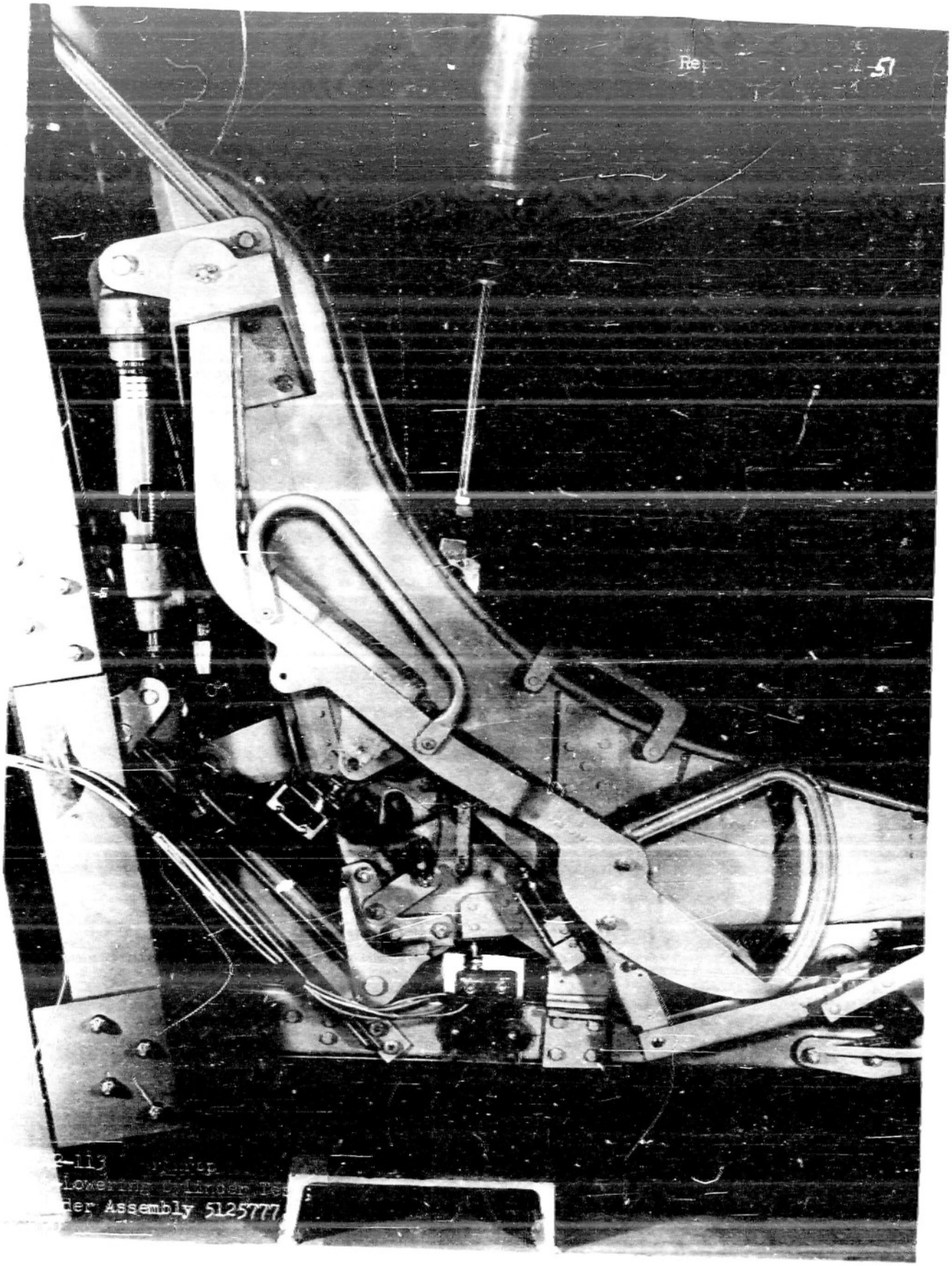
71952-123 Nor...
Pilot's Gas Operated Seat, "A"
Frame Casting Static Test Set-
up, Front ... F-80...



71953-1 Northrop
Pilot's Catapulted Seat, "A" Frame Casting, Static Test Set-up, 3/4 R.H. Side View F-89D



~~672-1-11~~
Seat-Lowering [illegible]t;
Pilot's Ejection Seat
5125850 F-89D



2-113
Lowering Cylinder Test
der Assembly 5125777

TEST WORK ORDER
Form 24-231 (8.11-52)

TYPE	NUMBER
QUALIFICATION	702018

SUBJECT: 5125850 SEAT ASSEMBLY - PILOT'S GAS OPERATED EJECTION - STATIC AND TEMPERATURE TEST

EWO: 5872-1

SALES ORDER: 40002

VENDOR	VENDOR NO.	MODEL
		F-89 D

TESTING ACTIVITY: Department 3461

EFFECTIVITY: B- TO B- (Incl)

TEST WITNESSES: Equipment Representatives, U.S.A.F. Representatives

SUPERSEDED BY TWO. NO. AT B-

SUPERSEDES TWO. NO. AT B-

TYPE OF TEST REPORT: FORMAL COMP.

TEST REPORT DISTRIBUTION: Test Admin. (1)
Equipment & Instr. (F98D Project (1)
F-89D Project Off. (1)
Eng. Test (1) Spec. Group (3)

PAGE 1 OF 4

OBJECT OF TEST

To obtain proof of sufficient static strength and to check operation at temperature extremes.

REFERENCE DATA

N.A.I. Drawings
5125850 Seat Assembly - Pilot's Gas Operated Ejection
5106277 Spacer Assembly - Seat Parachute Back
N.A.I. Inspection Test Work Order
983775 Seat Assembly - Pilot's Gas Operated Ejection (After Installation)
983776 Seat Assembly - Pilot's Gas Operated Ejection (Before Installation)
U.S.A.F. Specifications
25282-B Seat ; Pilot Ejection, Upward, Type C-1b

TEST SPECIMEN (S)

5125850 Seat Assembly - Pilot's Gas Operated Ejection

SUGGESTED TEST PROCEDURE

1. TEST SPECIMEN

1.1 The seat shall be mounted on ejection rails and shall be retained in a test jig by the fitting which receives the catapult trunnion.

1.2 Prior to starting any tests the seat shall be inspected per Northrop I.T.W.O. 983775 and 983776.

	SECTION	APPROVAL SIGNATURES	DATE
REQUESTING	Equipment 3515	W.J. Fuller Ed Martin	6-5-53
COORDINATING			
OTHER			
MECH. DES. OFFICE			7-15-53
STRUCT. OFFICE			
PRODUCTION PLANNING			
PROJECT OFFICE	F-89D		7-23-53
TEST DEPARTMENT	M.M. Morris for	F.B. Bolte	7-29-53 RELEASED

NORTHROP AIRCRAFT, INC.

SUGGESTED TEST PROCEDURE (Cont'd.)

1.3 Test Equipment

1.3.1 Dial indicators and/or other suitable means shall be used to measure deflections during all static tests.

1.3.2 Cameras shall be used to make suitable photographs during all tests.

2. SEAT ADJUSTMENT TEST

2.1 Check the force on the seat bottom contributed from the loading mechanism this shall not exceed 150 pounds when the seat is in the lowest position and shall not be less than 35 pounds when at the highest position.

3. TEMPERATURE TESTS

3.1 Room temperature

3.1.1 With the seat in the high-forward position and the air bottle charged (see paragraph 5.1) Actuate seat bottoming system by raising R.H. armrest the pneumatic seat bottoming system shall override the normal adjusting system and shall cause the seat bucket to move to the low-aft position with no undesirable jolt. The actual time required for the travel and the accelerations developed shall be measured and recorded. Time required for seat bottoming shall not exceed (1) second. The net downward force on the seat bucket tending to lock or hold the bucket in the low-aft position shall be measured and recorded. This net downward force (Vertical component) shall not be less than 450 pounds.

NOTE: After test, air pressure can be released by returning valve to original position.

3.2 Low Temperature (-35°F)

3.2.1 Test per paragraph 3.1.1 shall be repeated. Time for bottoming shall not exceed (1) sec.

3.3 High Temperature (+120°F)

3.3.1 Test per paragraph 3.1.1 shall be repeated. There shall be no undesireable jolt of the seat upon bottoming.

4. STATIC TESTS

4.1 Personnel Catapult Load

4.1.1 The seat shall support a load of 6600 pounds ultimate and 4400 pounds proof downward through the combined center of gravity of the pilot (see paragraph 5.2) and the seat, and parallel to the center line of the seat rollers. The load shall be uniformly distributed over the seat bottom. The seat shall be adjusted to the low-aft or ejection position while this load is applied.

SUGGESTED TEST PROCEDURE (Cont'd.)

4.2 Seat Bottom

4.2.1 The seat bottom shall support a load of 4000 pounds ultimate and 2665 pounds proof, applied downward through the center of gravity of the pilot and perpendicular to the seat bottom. The load shall be uniformly distributed over the seat bottom. The seat shall be adjusted to the high-forward position while this load is applied.

4.3 Seat Back

4.3.1 The seat back shall support a load of 1500 pounds ultimate and 1000 pounds proof applied perpendicular to the back and uniformly distributed over the area normally occupied by the parachute. The back shall be horizontal and facing upward. The seat shall be adjusted to the high-forward position while this load is applied. The maximum deflection of the seat back shall not exceed .625 inch while the back supports the ultimate load.

4.4 Seat Back With Spacer

4.4.1 Test per paragraph 4.3.1 shall be repeated with parachute back spacer (#5106277) in position.

4.5 Front Edge

4.5.1 With the seat bottom horizontal, the seat shall support a downward load of 400 pounds ultimate and 270 pounds proof applied to the top front edge of the seat bottom over a length extending 1.50 inch to each side of the center of the seat.

4.6 Armrests

4.6.1 Each armrest shall support a load of 300 pounds ultimate and 200 pounds proof applied downward and parallel to the center line of the rollers. Each armrest shall also support a horizontal side load of 100 pounds applied outward or inward perpendicular to the arm rest. These loads shall be applied at the center of the arm guards

4.7 Hand Grips

4.7.1 Each hand grip shall support a load of 100 pounds ultimate and 70 pounds proof applied at the upper end of the grip in forward and rearward directions parallel to the armrests

4.8 Head Rest

4.8.1 The head rest shall support a load of 200 pounds ultimate and 130 pounds proof applied rearward in a direction parallel to the seat bottom and uniformly distributed over the head rest.

SUGGESTED TEST PROCEDURE (Cont'd.)

4.9 Safety Belt

4.9.1 The seat shall support individual simultaneous loads of 2880 pounds ultimate and 1920 pounds proof applied to the lap belt mountings on the sides of the seat in a direction inclined 20 degrees inward and 40 degrees up from the bottom of the seat; and 2080 pounds ultimate, 1385 pounds proof applied to the shoulder strap take-up mechanism, in the unlocked extended position, in a forward direction parallel to the seat bottom and over the shoulder harness support member. The seat shall be adjusted to the mid-position while these loads are applied.

5. INSTRUCTIONS

5.1 Charge air bottle to 1800 P.S.I. gage at ≠ 70°F.

5.2 The center of gravity of the pilot is located on the center line of the seat at a distance of 18.6 inches from the seat back and a distance of 14 inches above the seat bottom.

5.3 The seat shall suffer no permanent deformation when tested to proof load or suffer failure when tested to ultimate loads as indicated in section 4.

5.4 Any failures which occur during these tests shall be analyzed for corrective measures. Any rework shall be done under supervision of the equipment section of electro-mechanical design, F-89D project.